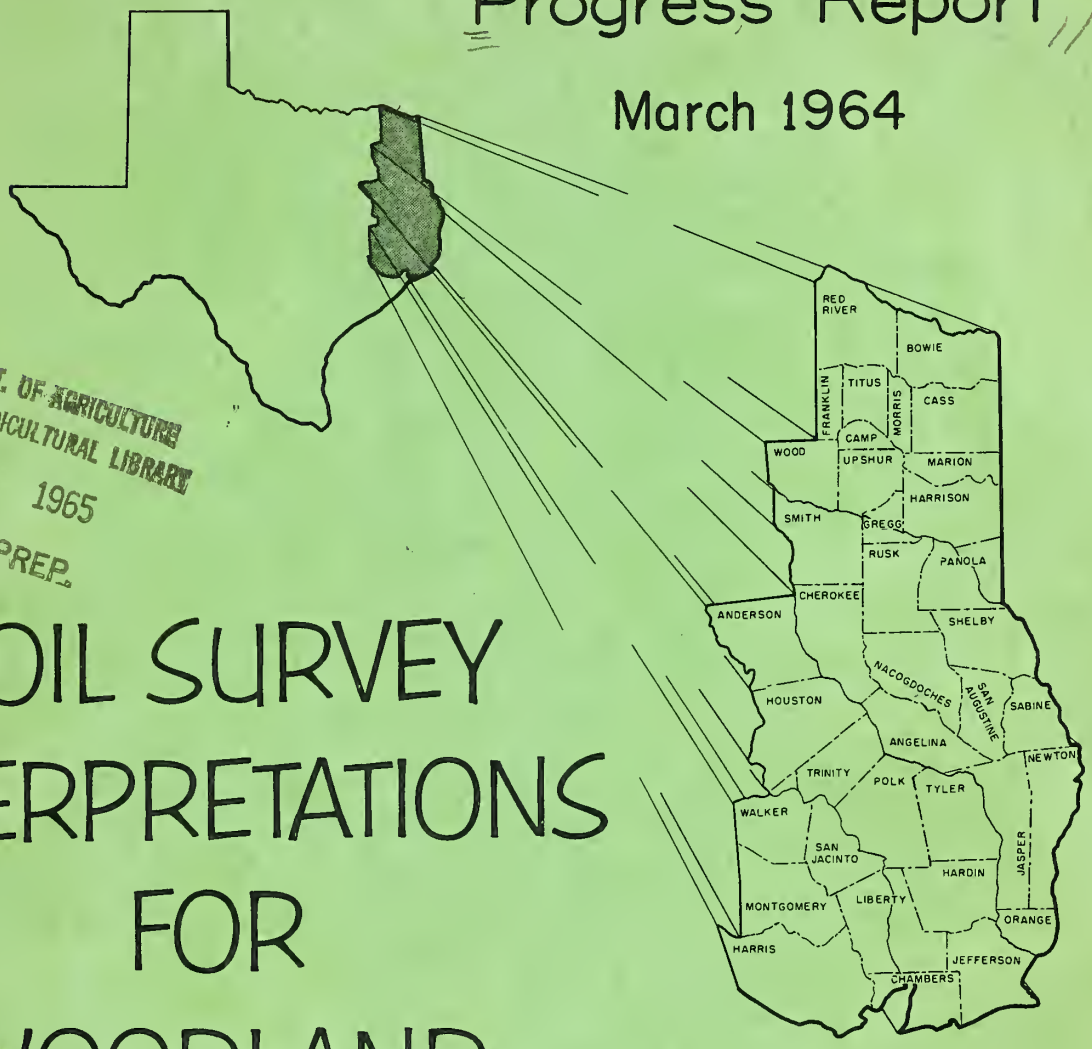
Texas

Progress Report

March 1964



SOIL SURVEY INTERPRETATIONS FOR WOODLAND CONSERVATION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Temple, Texas

4-17609 Rev. 3-64

SOIL SURVEY INTERPRETATIONS FOR WOODLAND CONSERVATION -- EAST TEXAS TIMBERLANDS, PROGRESS REPORT

By
L. L. Gordon, E. C. Wilbur, and Gordon S. McKee[1/]

ACKNOWLEDGMENT

The authors wish to express their appreciation to all who contributed in the development of this report, especially Soil Scientists W. B. Buckley, J. D. Crout and Wm. R. McClintock and to Woodland Conservationists L. L. Fisher, A. A. Smith and J. C. White. L. K. Brink, Woodland Conservationist, formerly with the Soil Conservation Service, contributed to collection of data. Through their assistance the Soil and Woodland information was collected. R. M. Voigtel, Soil Scientist, formerly with the Soil Conservation Service but now deceased, also contributed to collection of data.

Appreciation is extended to Harvey Oakes, Soil Correlator for the Soil Conservation Service, for his assistance in correlating soils of the sample plots and to James Coover, State Soil Scientist, who provided inspiration and guidance. Recognition and appreciation is also expressed for the assistance of Dr. Paul E. Lemmon, Soil-Woodland Specialist, Soil Conservation Service, Washington D. C. and Arthur E. Ferber, Woodland Conservationist, Soil Conservation Service, Denver, Colorado, in outlining and analyzing the material for the report.

1/ Soil Scientist (retired), Woodland Conservationist, and Soil Scientist, respectively, USDA, Soil Conservation Service, Temple, Texas

SOIL SURVEY INTERPRETATIONS FOR WOODLAND CONSERVATION

EAST TEXAS TIMBERLANDS PROGRESS REPORT

CONTENTS

Figures

CONTENTS (Continued)

Tables

INTRODUCTION

This progress report of soil survey interpretations for woodland conservation in East Texas provides: (1) a source of basic information, by different kinds of soils, for developing portions of the woodland sections of Soil Conservation Service Work Unit Technical Guides[1/], and (2) a source of information for preparing sections of individual county soil survey report manuscripts for publication.

Soil interpretations[2/] are based on the kinds of soils or taxonomic units. A taxonomic unit or classification unit is a unique kind of soil that has defined characteristics and qualities, including length, breadth, and depth. Soil maps show kinds of soil areas or soil mapping units. The name of the mapping unit is derived from the kinds of soils that dominate the mapping unit. A given mapping unit usually is 85 percent or more of one kind of soil, and in such case, it carries the name of that taxonomic unit. If two or more kinds of soils are dominant, the name of the mapping unit may carry the name of more than one taxonomic unit.

Soil surveying in Texas dates from 1901 (Highway Research Board, 1957). Efforts were greatly expanded about 1934, when the Soil Conservation Service entered the soil survey field. Advancements in all phases of soil technology have resulted in a steady flow of improvements, including better soil maps. More complete and accurate information has been provided about the physical and chemical characteristics of different kinds of soil. Classification and naming of soils by a national system has provided much clarification and coordination among different survey areas. Soil interpretations have been continually sought and, when available, have been summarized in convenient form for use with soil maps. Landowners and operators have learned much about the importance of accurate soil information as it affects their soil-use and management decisions. Their recognition of and enthusiasm for soil information have stimulated all phases of the soil survey program.

1/ A Technical Guide is an assemblage of technical information that applies specifically to the conservation of soil, water, plant and wildlife resources of a particular area for which it is prepared. Technical Guides are developed and kept up-to-date by staff specialists in each subject matter discipline such as Agronomy, Range, Woodland, Wildlife, Engineering, Soils, etc. Information is reviewed by like specialists in cooperating agencies and organizations. It is used by Soil Conservation Service technicians in assisting landowners and operators to plan, apply, and maintain conservation measures on their lands.

2/ Soil interpretations are predictions of how each different kind of soil is expected to behave under defined situations, especially systems of soil use and methods of manipulation. Interpretations range from such specific items as tile spacing, suitability of soil for highway subgrades, and potential erodibility, to more broadly defined qualities such as productivity for groups of crops, suitability for wildlife habitat, etc. (Kellogg, 1961).

Hockensmith (1960) gives a review of the National Cooperative Soil Survey. He explains how the Federal, State and local agencies and private organizations cooperate in making soil surveys. He describes how a soil survey is made, what information it provides, and how it may be used in managing soils for different purposes.

In the past, soil surveys were most urgently needed for cultivated crop production. It was natural that soil maps and soil interpretations were directed more particularly for these needs. Recently a mounting interest has developed in growing trees as a crop. This is true in East Texas, where forests have always been important, but where acres devoted to this crop are increasing due to planting and natural regeneration of idle croplands. The Forest Service (1956) shows that about half the land area in the northeastern counties in Texas is forested and that forested area increased 14 percent from 1935 to 1956. Similarly, in the southeastern counties about two-thirds of the area is forested, an increase of 5 percent during the same period.

The Soil Conservation Service began to intensify its efforts to provide suitable soil maps and interpretive material for woodlands in East Texas about 1948. One of the most useful woodland soil interpretations is the potential soil productivity for adapted woodcrops.[3/] Potential soil productivity is obtained by measuring the performance of existing forest stands on different kinds of soils. Six hundred and nine study sites have been measured and the information obtained is included in the Appendix of this progress report. The work has been concentrated on three important tree species (woodcrops); loblolly pine (Pinus taeda, L.), shortleaf pine (Pinus echinata, Mill), and longleaf pine (Pinus palustris, Mill). Similar information for other woodcrops such as mixed upland oaks and southern hardwoods is needed, and will be summarized later as it is obtained.

Slash pine (Pinus caribaea, Morelet) is an introduced species, and has been planted extensively in the cut-over longleaf pine area and on abandoned cropland in eastern Texas. Few stands older than about 20 years are available for sampling. Since those stands are all from planting, different basic research is needed as a basis for assessing soils for potential productivity of this woodcrop. No efforts have been made in the present work to obtain information for slash pine. As a guide, however, it may be assumed that site indexes[4/] for slash pine will be similar to that for loblolly pine on the same soils. Data from Louisiana (Loftin et al, 1959) appear to support this statement.

3/ A woodcrop may be a single tree species or a mixture of tree species that will be harvested as the final crop. In many cases they are represented by named and described forest cover types (Soc. Amer. For., 1954).

4/ Site index, the average total height of the tallest trees (dominant and codominant crown classes) in a well-stocked stand at 50 years of age, is accepted as being the best indicator of site quality for southern pines (Coile, 1948, USDA, 1929).

Each different kind of soil important to woodland use has been "rated" for relative potential hazards and limitations that need to be considered when using and managing them as woodland. These ratings include such soil-related items as seedling mortality, plant competition, equipment limitations, erosion hazard, windthrow hazard, and hazards from certain pests and diseases. Definitions of these items and criteria used in rating the different soils are included in the Appendix.

All soils that have been mapped in East Texas have been placed into thirty-two (32) woodland suitability groups. These groups have been based on information about suitable species, the potential productivity for woodcrops, the relative ratings of important potential hazards and limitations, and recognized physical and chemical characteristics of the different soils. Tables showing these groups by Major Land Resource Areas and explanations of the groups comprise the main parts of this progress report.

DESCRIPTION OF THE AREA

Pine-hardwood and bottom land forests of Texas are mostly in parts of the eastern 37 counties, in which they occupy over 60 percent of the land area or about 12.5 million acres (Texas Forest Service, 1963). The general location of major forest types are shown in Fig. 1 (U. S. Forest Service, 1956). The softwood types, those including pine, make up about two-thirds of the total forested area. The most extensive type is loblolly-shortleaf pine occurring in the southern portion where rainfall is higher. Longleaf-slash pine type grows almost entirely in the southeastern counties. The oak-pine type is found along the northwestern portion of the main pine growing area and the oak-hickory type is in the west and northwest part of the area where rainfall generally is lower. Small linear areas of oak-gum-cypress type extend along the main waterways through the area of East Texas. A strip of Coast Prairie and Marsh, not classed as forest land, is in the southernmost counties, near the coast. This report does not include information on the "Lost Pines" area of Bastrop, Fayette and Caldwell Counties, Texas.

For conservation purposes, the Soil Conservation Service has divided East Texas into four Land Resource Areas, illustrated in Fig. 2. They are (1) East Texas Timberlands (FC), with a subdivision of Flatwoods Portion of East Texas Timberlands (FCC), (2) Coast Prairie (CO), (3) Blackland Prairies (BL), and (4) Coast Marsh (GM). Land resource areas may be considered as "natural" areas within which certain environmental factors such as climate, soils, physiography and vegetation are relatively uniform. Likewise, potential land uses, conservation and agricultural requirements are relatively uniform within these areas. This report summarizes, by land resource, the soil survey information that is important to woodland use and management by land resource area.

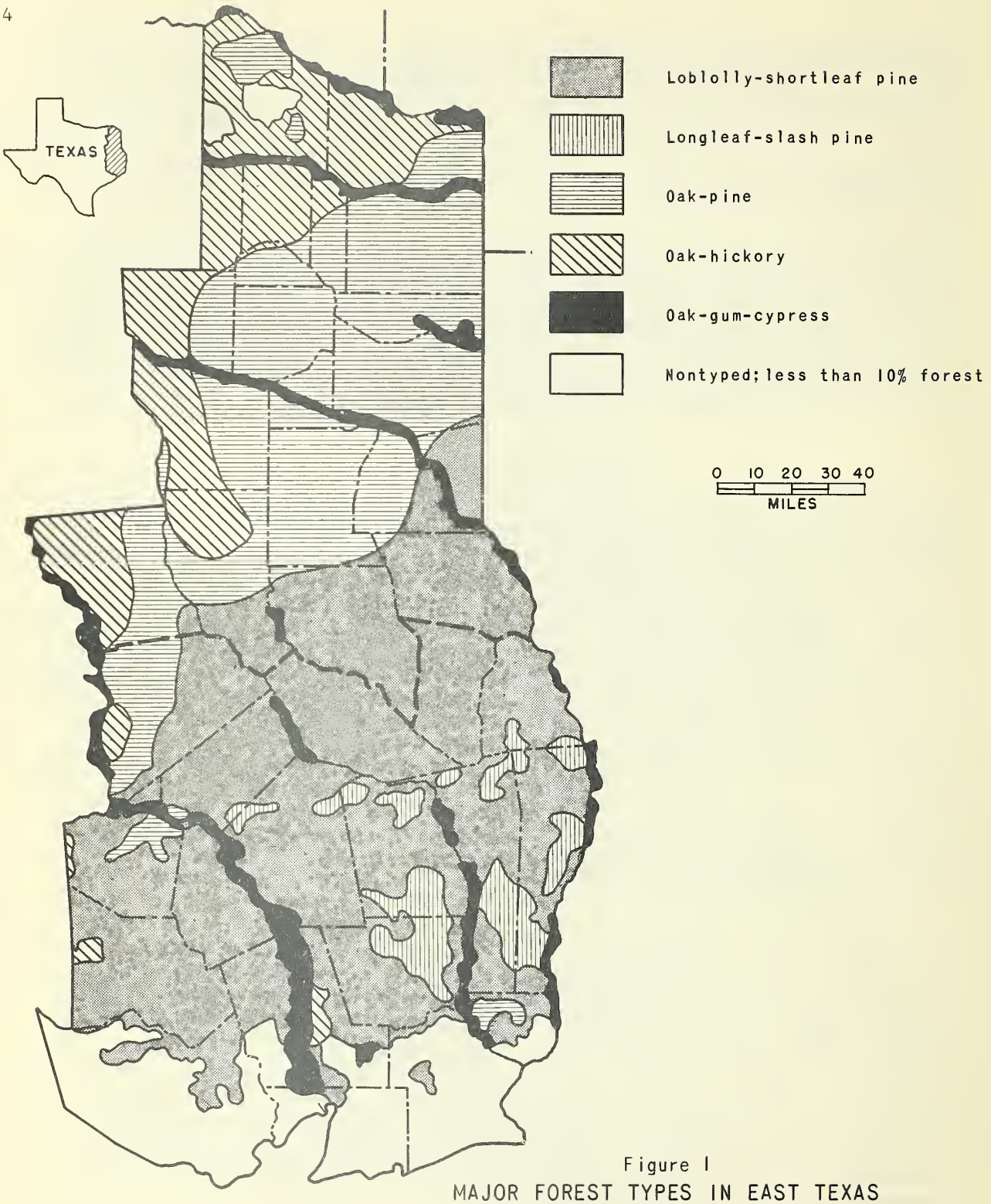


Figure 1
MAJOR FOREST TYPES IN EAST TEXAS
FROM FOREST SURVEY RELEASE 77
Southern Forest Experiment Station, New Orleans, Louisiana

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple Texas
4-17609 REV. 3-64
Rev. 5-63 4 R-12462

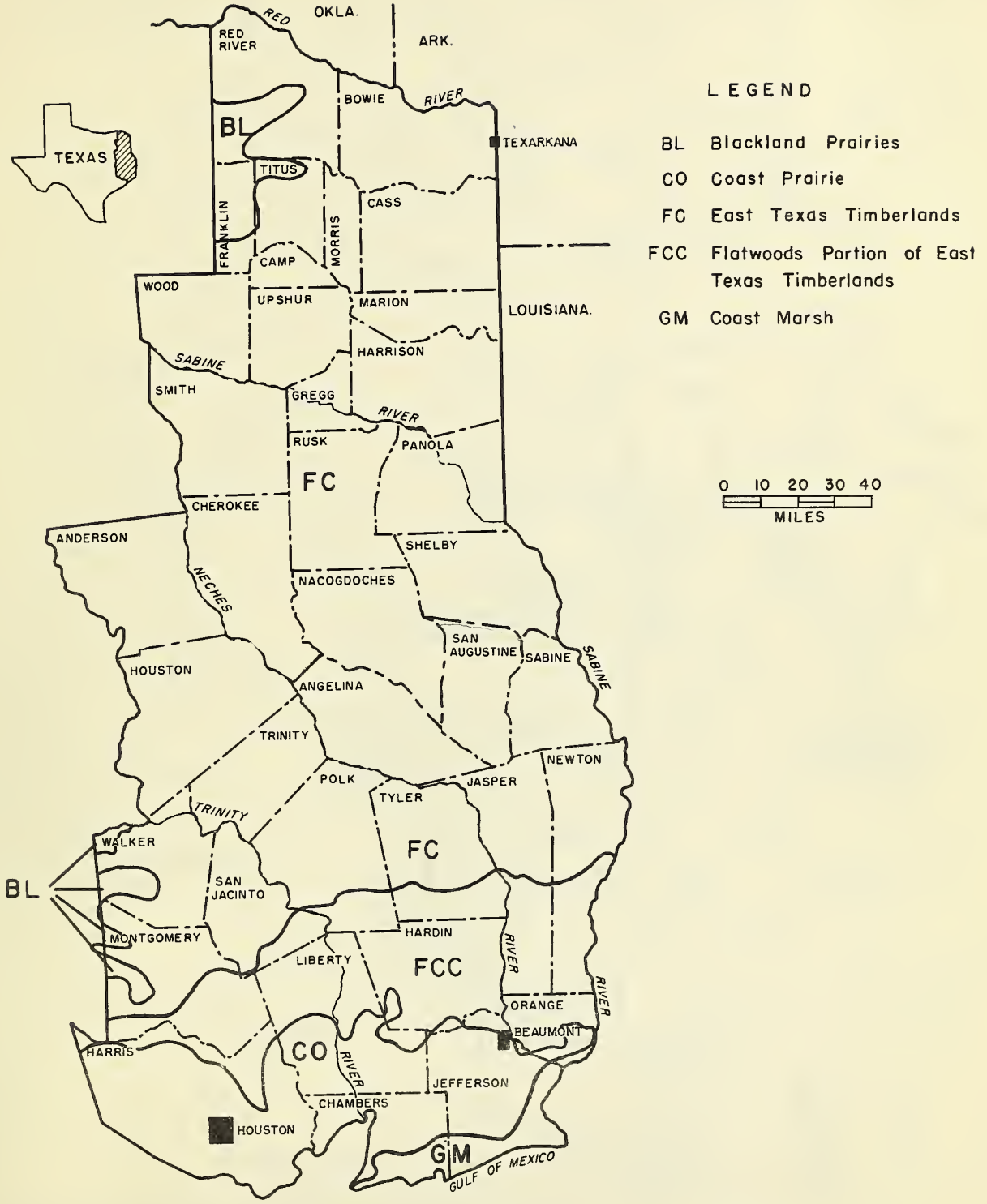


Figure 2
LAND RESOURCE AREAS OF EASTERN TEXAS

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple, Texas Rev. 5-63 4-L-12464

4-17609 REV. 3-64

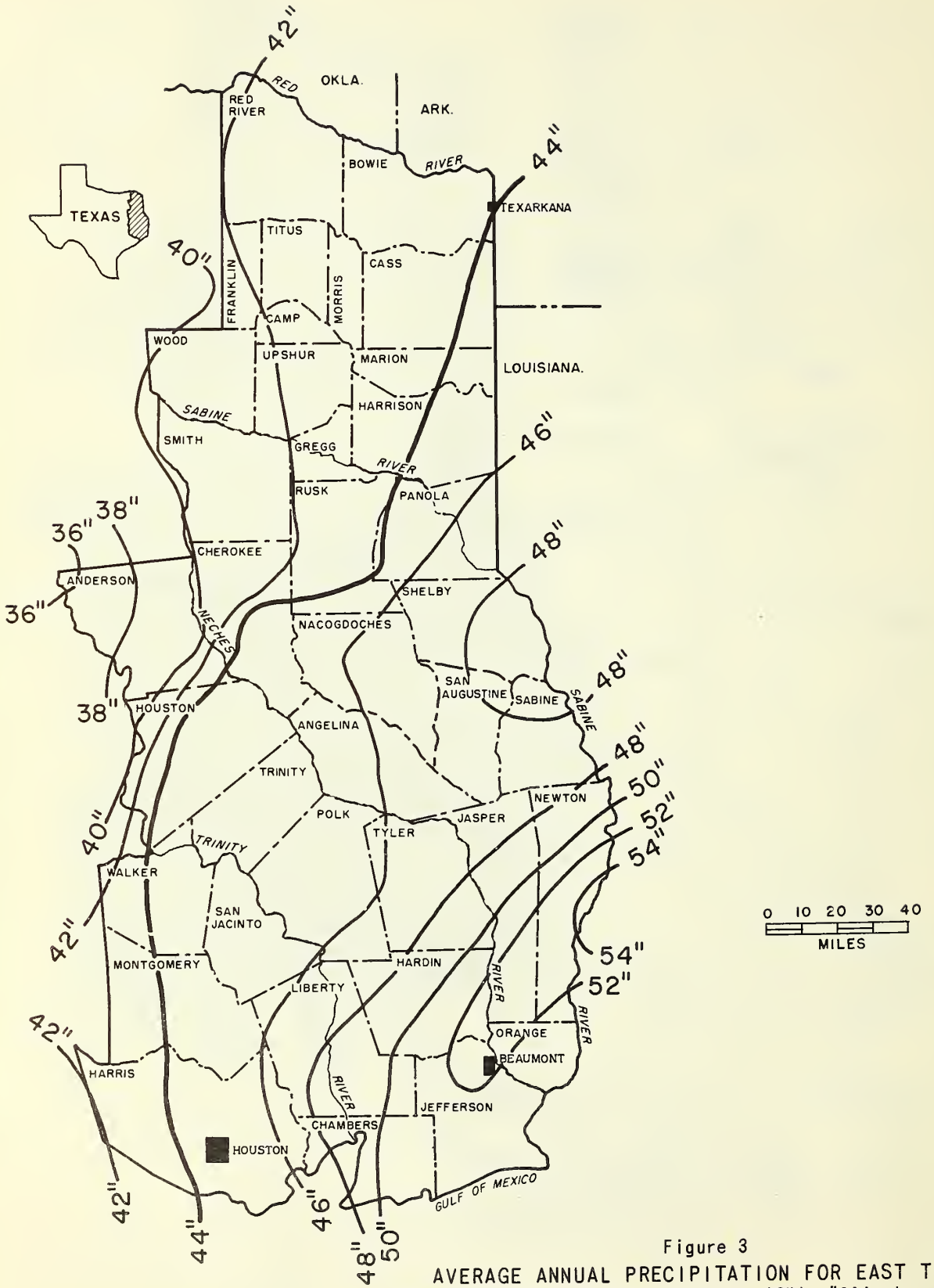


Figure 3

AVERAGE ANNUAL PRECIPITATION FOR EAST TEXAS

Based on data from USDA Yearbook, 1941, "Climate and Man"

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple, Texas

Rev. 5-63 4-L-12463

4-17609 REV. 3-64

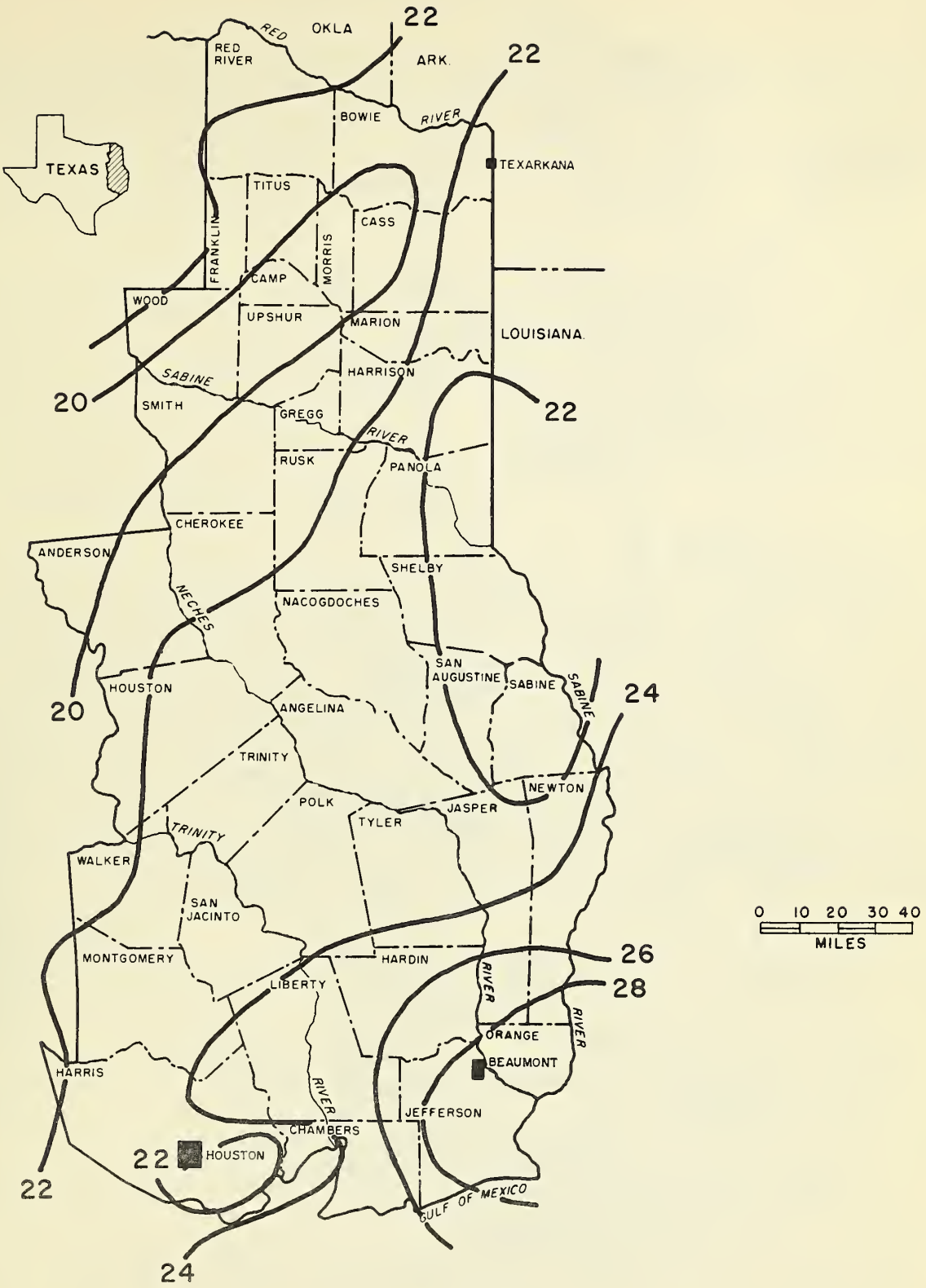


Figure 4

AVERAGE WARM-SEASON PRECIPITATION - INCHES
APRIL TO SEPTEMBER, INCLUSIVE
Based on data from USDA Yearbook, 1941, "Climate and Man"

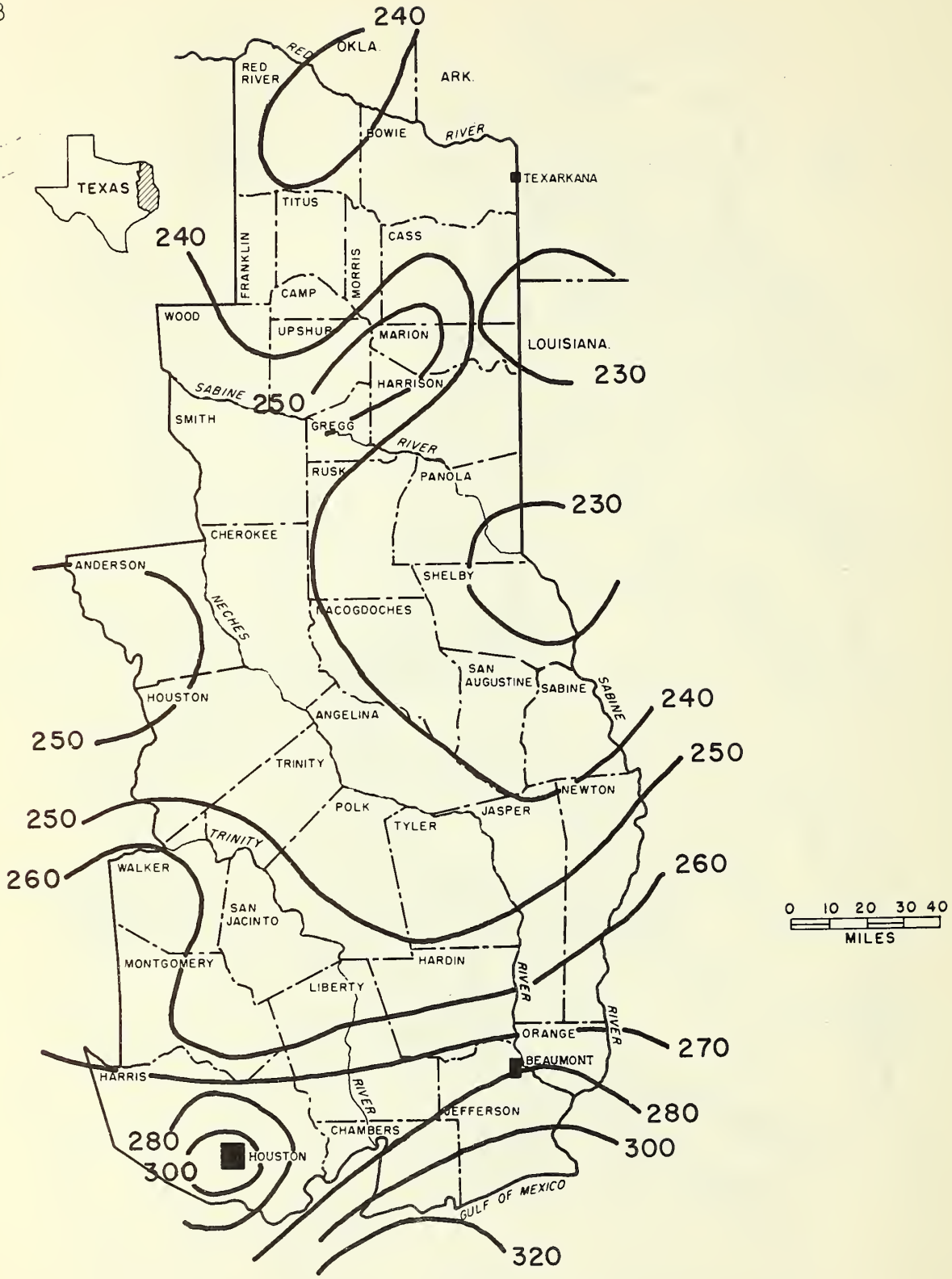


Figure 5

AVERAGE NUMBER OF DAYS WITHOUT KILLING FROST

Based on data from USDA Yearbook, 1941, "Climate and Man"

PREVIOUSLY RELATED WORK

Many studies have been reported, especially during the past ten years, concerning relationships between soils and the growth of trees. Some of the studies apply directly to the species and area included in this report. A brief review of some of these papers follows. No attempt is made to give a complete literature review. Readers are referred to the original papers summarized below for this information and to more complete literature sources that are referenced in them.

Turner (1937, 1938) studied 222 one-quarter and one-half acre plots in shortleaf and loblolly pine stands located in Ashley, Columbia, Bradley and Howard Counties, Arkansas. These counties apparently were considered to be representative of the Forested Coastal Plain Area. He determined site indexes and rates of volume growth on 22 soil types and has presented detailed information. The results are discussed by site quality groupings of soils; six site classes are recognized for loblolly (110, 100, 90, 80, 70, 60) and four for shortleaf pine (90, 80, 70, 60). Some excellent ecological and silvicultural comments are given for each site class that should be helpful in devising better woodland conservation practice specifications.

Turner used published county soil surveys as a basis for identifying soils as they were examined in the field. Samples were collected also, and analyzed in the laboratory. In order to group the plot information so that like site-quality would be shown, it apparently was necessary for the author to recognize soil phases not included in the county soil surveys. These phases have been called "superior", "medium", and "inferior". Some of the plots were located on transitional zones between recognized soil types and they have been so designated. The need for recognizing phases, not shown in soil mapping at the time, indicates that the mapping units were too broad to provide the necessary control for practical woodland management based on soil survey information. Results of Turner's work were among the first to be published about woodland soil relationships in the United States. Soil mapping units have been improved and refined in recent years and current soil mapping is providing the necessary basis for better woodland conservation.

Zahner (1954, 1957, 1957a, and 1958) studied 206 shortleaf and loblolly pine stands in southern Arkansas and northern Louisiana. He determined, by complex statistical analyses, that site index is closely related to three site factors: (1) surface soil thickness and texture, (2) subsoil texture, and (3) slope. On zonal soils (those with ABC horizon sequence, and without such features as claypans) the increase in surface soil thickness to a maximum of 18 inches correlated directly with increasing site index. Above 18 inches the site quality decreased with increasing thickness of the surface soil. On azonal soils, as classed by Zahner, (those where the surface soil grades gradually into the subsoil), site index increased with increasing amounts of silt in the upper 6 to 12 inches of the soil. Subsoil texture of both zonal and azonal soils was correlated with site index. That is, the index increased as subsoil texture increased in clay content from sandy loams to clay loams. Soils with friable clay loam subsoils had higher site indexes than soils with plastic clay and silty clay subsoils. Site index decreased as slope percent increased on the zonal soils of the uplands. Shortleaf pine was not a common associate of loblolly pine on the azonal soils. The site

index of shortleaf may be estimated from that of loblolly pine on these soils by using Zahner's formula: site index of shortleaf pine = 13 + 0.77 (loblolly pine site index).

Chandler, et al, (1943) report studies on fourteen, mostly one-acre plots of shortleaf and loblolly pine stands in Polk, Tyler, Angelina, and Nacogdoches Counties, Texas. These counties are part of the "Eastern Texas Pine Belt", which is under consideration in this report.

Average site indexes are:

Soil Type	Shortleaf pine	Loblolly pine
Ochlockonee fine sandy loam	100	103
Lufkin fine sand	74	82
Segno fine sandy loam	72	81
Ruston fine sandy loam	74	80
Caddo fine sandy loam	73	78
Susquehanna fine sandy loam	68	73
Segno fine sand	62	58

Most of the values agree essentially with those reported later in this paper for like soil types, some of which are now classified in different series.

McClurkin (1953) in a study of the relationships between soil and climatic factors, and the growth of longleaf pine in Louisiana, Mississippi, and Texas, presented information to support the conclusion that site quality could be predicted from the amount of rainfall the site receives during the first six months of the year, and the depth to the least permeable horizon in the soil. He recognized the difficulty, however, of determining the least permeable horizon in some soils.

COLLECTION OF INFORMATION

Soil-site index data presented in this report were collected by the Soil Conservation Service since 1955 (Appendix Tables 1 through 7). Field work was done by two-man teams, a soil scientist and a woodland conservationist, working together. These men were familiar with the soils and woodlands of the area. General locations of the sites studied are illustrated in Fig. 6. More detailed information about the specific location of each site is on file in the State Office of the Soil Conservation Service, Temple, Texas.

Six hundred and nine sites were studied. These were divided among the different species, resource areas, and rainfall belts as follows:

Land Resource Areas (See Fig.2)	Species			
	Loblolly	Shortleaf	Longleaf	Total
East Texas Timberlands (FC)				
Precipitation 44 inches and above	172	160	27	359
Precipitation less than 44 inches	28	97	0	125
Flatwoods portion of East Texas Timberlands (FCC)	67	10	24	101
Coast Prairie (CO)	23	0	1	24
Totals	290	267	52	609

Selection of suitable study sites was a joint responsibility of the soil scientist and woodland conservationist. Soils were excavated by spade and auger to a depth of 72 inches, or deeper if need indicated. The soil scientist wrote a complete soil profile description according to standard procedure (USDA, 1951), if the soil was well within the range of a known taxonomic unit, and if the forest stand was suitable for study. At any site where the soil profile characteristics varied only slightly from a modal soil already described, notes were recorded of those minor soil differences from one already described instead of writing another complete soil profile description. The team avoided areas where soils were intergrades between soil types (transitional areas). Sites were avoided also where abnormal conditions were present that might have affected tree growth, such as abandoned farmstead, desurfaced land, overgrazed areas, seeps and excessively drained areas due to gullies. The soil at each site was identified as to soil series, type and phase according to the national system of soil classification used by the Soil Conservation Service.

Only well-stocked, even-aged stands of natural origin were sampled. Overstocked and stagnant stands were avoided. Three or more trees were measured on each site, except in a few cases where fewer trees were suitable for measurement. Sample trees were always either dominants or codominants, the taller trees in the stand. Trees were not sampled if they had disease or damage symptoms, such as heart rot, cat faces, turpentine faces, top breakage, and logging or fire damage. Measured trees were 10 inches or more in diameter at breast height and varied in age from 30 to 84 years. Age of measured tree was determined by annual ring count of increment boring sample made at breast height to the pith or center of the trees. Three years were added to the ring count for loblolly and shortleaf, and seven years to longleaf to determine total age. Tree height was determined with Abney hand level and measuring tape. Site index was determined for each tree separately and recorded. Site index curves published by Coile and Schumacher (1953) were used for loblolly and shortleaf pine, and those published by the USDA (1929) were used for longleaf pine. Average diameter, height, age, and site index for all trees measured on a site were determined and recorded, as well as individual tree measurements[5/].

5/ For a complete list and explanation of items measured, observed and recorded for each site, see pages 87 and 88.

Information recorded for soil-site index correlation plots is shown in Appendix Tables 1 through 7. A summary of the average measurements by soil taxonomic units is provided in Tables 1, 2, and 3. Average site index for a soil may be converted to average annual per acre growth by use of the curves in Fig. 8. More complete information for fully stocked forests of different species is available from published yield tables (USDA, 1929). Some of this information is included in Appendix Tables 8 through 11 of this report.

Table 1. Average site index of loblolly, shortleaf and longleaf pine for some soils in the East Texas Timberlands (FC) Resource Area.

Soil[1/]	Loblolly			Shortleaf			Longleaf		
[2/]	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation
ANNUAL PRECIPITATION 44 INCHES AND OVER									
Bibb cl	1	98							
Bibb sicl	1	101							
Boswell fsl and Boswell vfsl	17	83	±5	23	75	±5	3	77	±8
Boswell gfsl and Boswell gvfsl	3	90	±3	4	81	±6			
Boswell gfsl, mod. shallow and Boswell gvfsl, mod. shallow	1	81		6	65	±5			
Boswell scl, severely eroded				1	76				
Bowie fsl and Bowie vfsl	3	79	±9	7	76	±3	1	72	
Bowie fsl, thick surface	3	86	±2	4	82	±6			
Bowie vfsl, thick surface	1	91		1	89				
Bowie lfs	6	92	±7	10	78	±5	1	85	
Byars cl	4	88	±5						
Byars vfsl, thick surface	1	90							
Caddo fsl and Caddo vfsl	2	83		3	77	±6	2	75	
Caddo fsl, thick surface and Caddo vfsl, thick surface	3	92	±6						
Caddo fsl, mod. shallow				3	69	±2	1	70	
Caddo lfs, clayey substratum variant	2	76							
Caddo lfs	2	88							
Conroe gfsl	2	74					1	66	
Conroe glfs	8	70	±4	3	59	±7			
Conroe lfs	9	76	±3						

1/ Refer to Page 88 for explanation of abbreviations for soil textural classes.

2/ The data for the plots are shown individually in Appendix Tables 1-7. Standard deviations are shown where trees on three or more plots were measured.

Table 1. Average site index of loblolly, shortleaf and longleaf pine for (Cont'd) some soils in the East Texas Timberlands (FC) Resource Area

Soils	Loblolly			Shortleaf			Longleaf		
	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation
Cuthbert fsl	2	81		4	75	±5			
Cuthbert fsl, mod. shallow	2	70		2	64				
Cuthbert gsl, mod. shallow				1	64				
Cuthbert lfs	3	79	±1	7	72	±4			
Eustis lfs and Eustis fs	1	86		5	80	±6			
Garner clay	7	75	±3	1	64				
Iuka cl, clay substratum variant	1	111							
Iuka cl, occasionally flooded	2	109							
Iuka fsl	2	110							
Iuka fsl, clay substratum variant and Iuka vfsl, clay substratum variant	3	108	±3	1	100				
Kirvin fsl and Kirvin vfsl	2	91		4	79	±4	1	78	
Kirvin gfsl	1	87		3	75	±4			
Kirvin gfsl, mod. shallow	1	62		1	60		1	59	
Kirvin lfs	1	79		2	74		2	78	
Klej lfs	3	89	±6						
Lakeland fs	2	86		3	81	±7	1	74	
Lakeland fs, very deep phase				1	66				
Lakeland lfs	3	86	±4	7	75	±5	3	72	±8
Lakeland lfs, mod. shallow	1	65		3	59	±2			
Magnolia fsl	1	81							
Magnolia fsl, terrace phase	3	105	±5	2	92				
Nacogdoches fsl				3	73	±9			
Nacogdoches gfsl				1	67				

Table 1. Average site index of loblolly, shortleaf and longleaf pine for (Cont'd) some soils in the East Texas Timberlands (FC) Resource Area

Soil	Loblolly			Shortleaf			Longleaf		
	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation
Plummer lfs, clay substratum variant	1	89		1	80				
Rains fsl, clay substratum variant	1	79		1	76		1	72	
Ruston fsl, thick surface	2	94		2	80				
Ruston fsl, terrace phase	1	98		1	94				
Ruston lfs	5	92	±7	8	80	±6	4	79	±6
Ruston lfs, terrace phase	2	94							
Sawyer fsl and Sawyer vfsl	14	87	±5	7	78	±3			
Sawyer fsl, moundy and Sawyer vfsl, moundy	2	82		4	73	±3	1	73	
Sawyer fsl, thick surface	1	81		3	78	±3			
Sawyer lfs	14	91	±7	5	74	±5	3	76	±3
Susquehanna fsl	12	82	±4	5	73	±5	1	73	
Susquehanna fsl, moundy	1	87		1	83				
Susquehanna fsl, thick surface	5	91	±11	3	86	±4			
Susquehanna lfs	1	78		3	69	±1			
ANNUAL PRECIPITATION LESS THAN 44 INCHES									
Boswell fsl	2	78		11	64	±4			
Boswell fsl, mod. shallow				2	62				
Bowie fsl	2	82		5	73	±4			
Bowie fsl, mod. shallow				1	66				
Bowie fsl, thick surface	2	85		3	79	±2			
Bowie lfs				11	75	±5			
Bub gfsl				1	58				

Table 1. Average site index of loblolly, shortleaf and longleaf pine for (Cont'd) some soils in the East Texas Timberlands (FC) Resource Area.

Soil	Loblolly			Shortleaf			Longleaf		
	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation
Byars fsl				1	68				
Caddo vfsl, moundy				1	76				
Caddo lfs				1	75				
Cuthbert fsl	2	78		2	73				
Cuthbert gfsl and Cuthbert gsl				4	65	±2			
Cuthbert fsl, mod. shallow				1	65				
Cuthbert fsl, thick surface				4	70	±2			
Cuthbert lfs				4	63	±4			
Eustis lfs and Eustis fs	1	70		2	65				
Iuka fsl, frequently flooded	2	104							
Kirvin fsl	2	80		4	73	±2			
Kirvin gfsl				1	68				
Lakeland fs				3	60	±2			
Lakeland fs, very deep				2	57				
Lakeland lfs	3	72	±5	12	66	±3			
Nacogdoches fsl	1	73		2	71				
Ochlockonee fsl	1	97							
Ruston fsl				1	74				
Ruston fsl, thick surface				1	81				
Ruston lfs	1	80		4	76	±2			
Sawyer fsl	2	75		1	78				
Sawyer fsl, moundy and Sawyer vfsl, moundy	3	79	±5	6	68	±3			

Table 1. Average site index of loblolly, shortleaf and longleaf pine for some soils in the East Texas Timberlands (FC) Resource Area (Cont'd)

Soil	Loblolly			Shortleaf			Longleaf		
	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation
Sawyer fsl, thick surface	1	78							
Sawyer lfs	2	88		2	70				
Susquehanna fsl				4	73	+5			
Susquehanna fsl, thick surface	1	80							

Table 2. Average site index of loblolly, shortleaf and longleaf pine for some soils in the Flatwoods Portion (FCC) of the East Texas Timberlands Resource Area

Soil	Loblolly			Shortleaf			Longleaf		
	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation
Acadia fsl	1	93							
Acadia fsl, thick surface	1	95					2	82	
Bowie fsl and Bowie vfsl	1	87					11	75	±4
Bowie fsl, moundy							3	82	±2
Bowie fsl, thick surface	2	86		1	80		3	79	±6
Bowie lfs	7	84	±5	3	77	±2	1	81	
Byars vfsl, thick surface, moundy	1	95							
Caddo fsl and Caddo vfsl	7	90	±7	1	82				
Caddo fsl, thick surface	6	93	±5						
Caddo fsl, clayey substratum variant	5	96	±3						
Caddo vfsl, clayey substratum variant	1	97							
Conroe fsl	1	91							
Eustis fs, terrace phase	1	88		2	78				
Garner clay	5	85	±3						
Iuka cl, frequently flooded	1	100							
Iuka fsl, undulating, frequently flooded	1	93							
Klej fs							1	74	
Klej fs, undulating	1	86		1	83		1	82	
Klej lfs	1	95							
Klej lfs, undulating	3	105	±10						
Klej lfs, thick surface	2	83					2	83	

Table 2. (Cont'd) Average site index of loblolly, shortleaf and longleaf pine for some soils in the Flatwoods Portion (FCC) of the East Texas Timberlands Resource Area

Soils	Loblolly			Shortleaf			Longleaf		
	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation
Lakeland fs	1	80							
Lakeland fs, very deep				1	67				
Magnolia fsl, terrace phase	1	96							
Rains vfsl	9	90	±5						
Rains vfsl, thick surface	3	94	±2						
Rains vfsl, clayey subsoil variant	1	79							
Ruston fsl, thick surface				1	81				
Sawyer fsl	1	92							
Sawyer vfsl, moundy	3	92	±7						

Table 3. Average site index of loblolly and longleaf pine for some soils in the Coast Prairie (CO) Resource Area

Soil	Loblolly			Longleaf		
	No. Plots Measured	Average Site Index in Feet	Standard Deviation	No. Plots Measured	Average Site Index in Feet	Standard Deviation
Beaumont clay	3	86	±4			
Clodine vfsl	1	92				
Edna cl	3	97	±6			
Edna fsl, moundy and Edna vfsl, moundy	3	89	±6			
Hockley fsl	2	84				
Katy fsl	2	93				
Katy fsl, moundy and Katy vfsl, moundy	4	94	±4	1	85	
Sabine lfs	2	92				
Waller cl, drained	1	99				
Waller vfsl, drained	2	111				

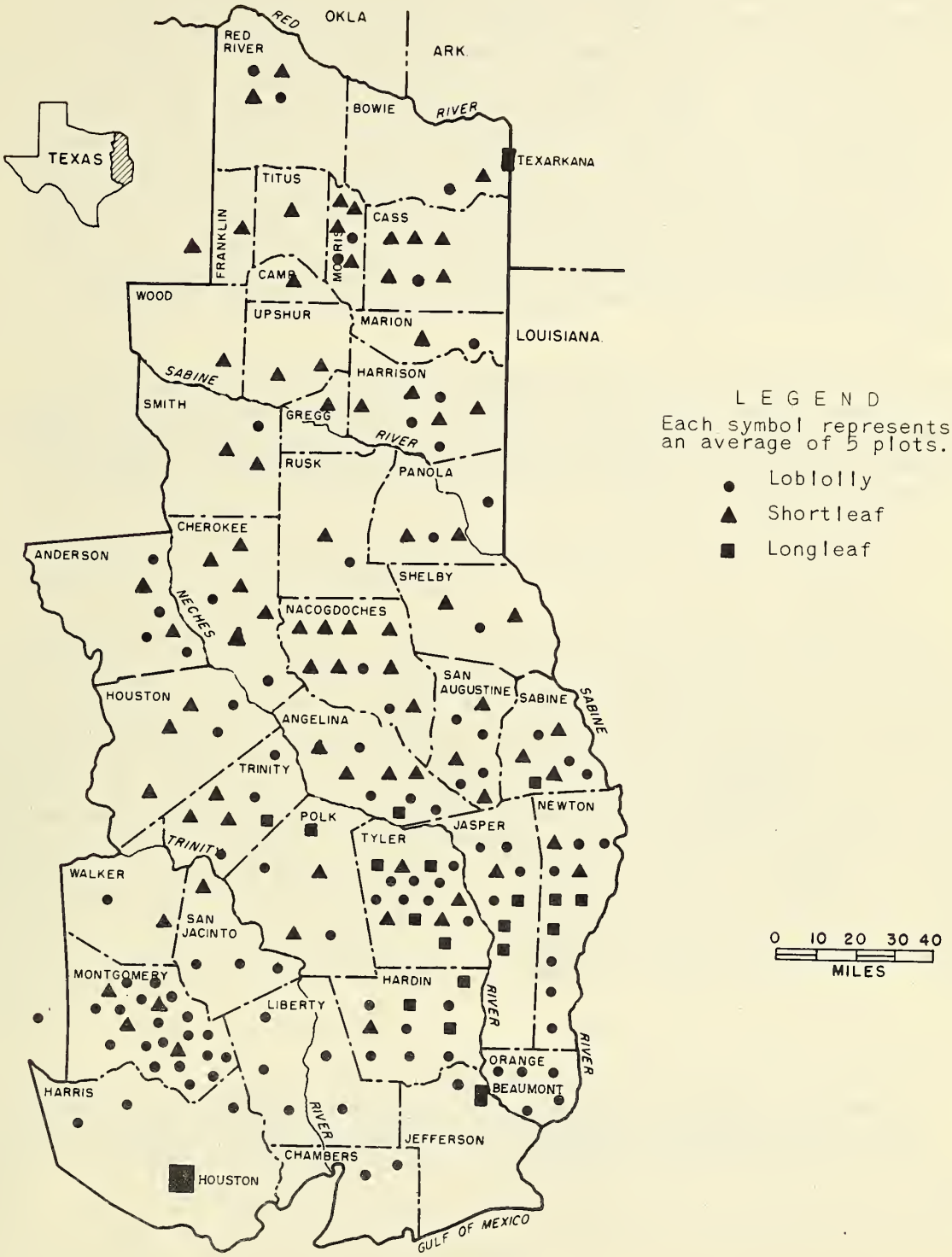


Figure 6

SOIL - SITE INDEX CORRELATION PLOT DISTRIBUTION BY COUNTIES

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple, Texas 5-63 4-L-17908

4-17609 REV. 3-64

ANALYSES AND GENERAL OBSERVATIONS

A complete statistical analysis of the site index information has not been completed. Sample analyses were made by plotting certain recorded items about the soil, climate, and physiography of each plot over average site index for the tree species measured. The items studied in this way were: average annual precipitation, soil depths to a restrictive layer, slope classes, erosion classes, plot positions, thicknesses of the A horizons, average warm-season precipitation, and periods without killing frost. It was concluded that these site factors are adequately considered for woodland interpretations by the soil mapping units used in making soil maps except for the influence of average annual precipitation in the East Texas Timberland (FC) Area. Following is an explanation of how the exception was handled in the East Texas Timberland (FC) Area, and some of the evidence supporting these conclusions.

Figure 7 illustrates the relationships between total annual precipitation and site index for shortleaf pine for two important groups of soil taxonomic units in the FC area. The two soils are shown in Figure 7 as: A - Boswell fine sandy loam and very fine sandy loam and B - Lakeland fine sand and loamy fine sand.

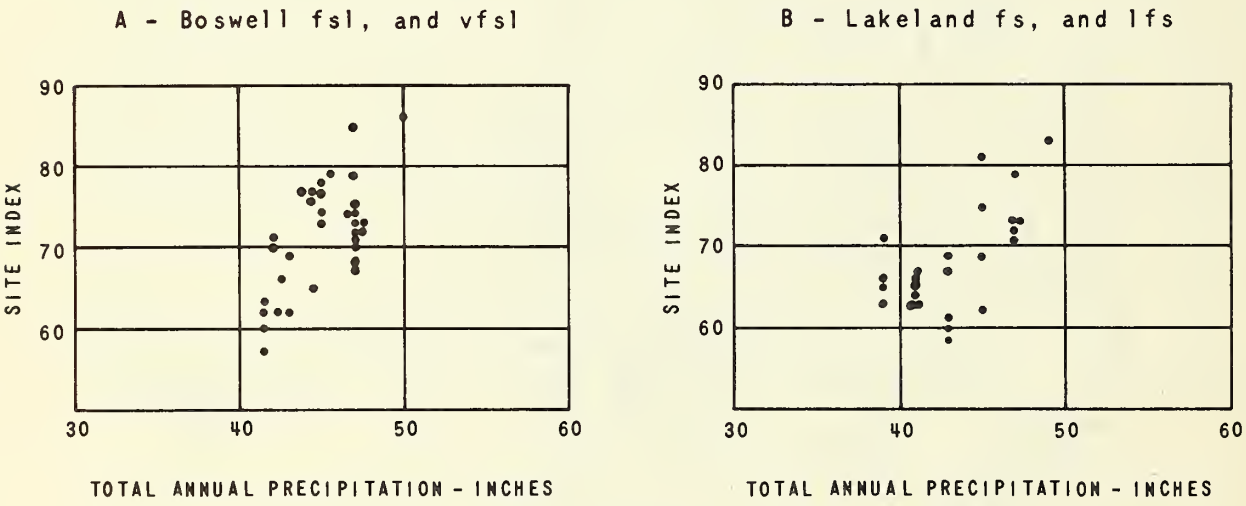


Figure 7

RELATION BETWEEN AVERAGE SITE INDEX OF SHORTLEAF PINE AND TOTAL ANNUAL PRECIPITATION FOR TWO GROUPS OF SOIL TAXONOMIC UNITS IN EAST TEXAS TIMBERLAND (FC) LAND RESOURCE AREA

On the basis of these plotted data and similar information for other important woodland soils, it was decided to break the resource area at the 44-inch isohyet and develop soil interpretations separately for the two portions. Table 4 summarizes site index data for loblolly and shortleaf pine for nine of the more important woodland soils occurring in both portions of the area. Although the data are weak in some respects, a consistent relationship (difference) is indicated in most cases between average site index of both species and the two rainfall zones. The effect of lower precipitation appears to be more important on the less drought-tolerant loblolly pine than on the shortleaf pine. This is indicated by the dearth of loblolly plots in the low precipitation area. Differences are more important on some soils than on others, as illustrated in Table 4. On some of the soils in the East Texas Timberland (FC) Area there are likely no significant differences due to precipitation. The least amount of influence would be expected on soils that have good soil-moisture relations, such as Bowie fine sandy loam.

Data presented in this report are presented separately for the two precipitation zones in the (FC) area. Average site indexes, therefore, are applicable to the precipitation zone from which the data came. With enough samples for reliable predictions, this method provides a basis for supplying adequate interpretations for all soils. Later analyses may make possible a more efficient use of the data by combining it for soils where proof is obtained that the range in precipitation throughout the pine-growing area of the (FC) area does not significantly influence tree site index.

Ecological information dealing with plant adaptation gives added support for subdividing the East Texas Timberland (FC) Area at the 44-inch isohyet. As shown in Figs. 1 and 3, the oak-pine and loblolly-shortleaf pine forest cover types separate very nearly on this line. The frequency of sampling different species may be taken as evidence of species adaptation, because the number of sites measured for a species is directly correlated with its presence in an area. Loblolly pine is not well adapted to the less drought-tolerant Boswell, Lakeland, and Susquehanna soils in the lower precipitation zone, but it occurs frequently and is a desirable species on similar soils in the zone of greater precipitation. Longleaf pine does not occur naturally in the low precipitation zone, but grows naturally and is managed commercially on many of the soils in the zone of higher precipitation. Longleaf pine is known to be less widely adapted than either loblolly or shortleaf pines.

Site index information was used to test the adequacy of some of the soil mapping units for woodland uses. This is one of the objectives of soil-woodland site correlation work. Soil mapping units must be designed for making predictions on the basis of soil taxonomic units within mapping units, and on existing information. Some mapping units, because of their importance in cultivated-crop uses of soils, are used for woodland mapping in the area of discussion, even though they may not be necessary in woodland management. Design of mapping units may need changing where the soils are expected to be used for woodland.

Moderately shallow phases of some soils are mapped (Table 5). Although rigid tests were not made, the data in Table 5 indicate a consistently lower site index on the moderately shallow phases than on their normal depth counterparts. The differences appear to be enough to justify the retention of the moderately shallow phases for woodland uses of the soils in question. Accordingly, interpretations presented in this report recognize these moderately shallow phases.

Slope and erosion phases did not prove to be significant in the study made for this report. The slope and erosion classes were recorded by the soil scientists in the field as data were collected, but no to little difference could be found in site index for the full range of slopes and erosion classes occurring in a given soil type.

Similar testing of other possible soil phases has led to some adjustments in recent soil mapping. Some combinations of previous mapping units have been made to develop the most useful soil-woodland interpretations presented in this report. All of the phases now shown for various soils in this report are considered justified at present, but testing them for adequacy in woodland uses will be an item of continuing attention.

Table 4. Average tree site index on selected soils in two precipitation zones of the East Texas Timberland (FC) Area

Soils	Pine Species: Loblolly Site Index	Loblolly No. Samples	Shortleaf Site Index	Shortleaf No. Samples
Low precipitation zone, less than 44 inches				
Boswell fine sandy loam, and very fine sandy loam	78	2	64	11
Bowie fine sandy loam	82	2	73	5
Bowie loamy fine sand	-		75	11
Cuthburt loamy fine sand	-		63	4
Eustis loamy fine sand and fine sand	70	1	64	2
Lakeland fine sand and loamy fine sand	72	3	66	15
Ruston loamy fine sand	80	1	76	4
Sawyer fine sandy loam	74	2	78	1
Susquehanna fine sandy loam	-		73	4
Weighted Average	76	11	70	57
High precipitation zone, 44 inches and over				
Boswell fine sandy loam, and very fine sandy loam	83	17	75	23
Bowie fine sandy loam	79	3	77	7
Bowie loamy fine sand	92	6	78	10
Cuthbert loamy fine sand	79	3	72	7
Eustis loamy fine sand and fine sand	86	1	80	5
Lakeland fine sand and loamy fine sand	86	5	77	10
Ruston loamy fine sand	91	5	80	8
Sawyer fine sandy loam	81	15	78	7
Susquehanna fine sandy loam	80	10	73	5
Weighted Average	83	65	76	82

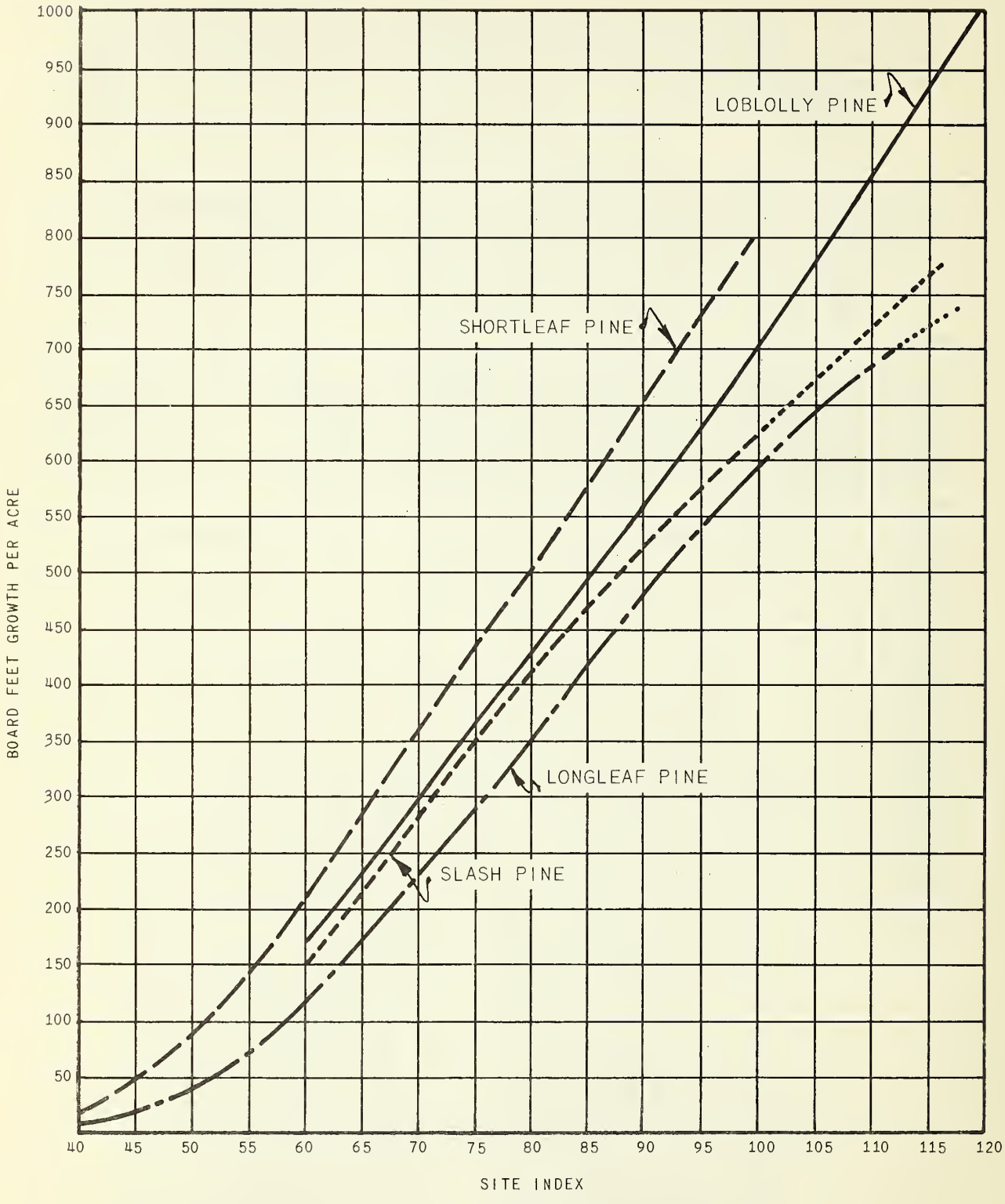


Figure 8

AVERAGE ANNUAL PER ACRE GROWTH (BOARD FEET, SCRIBNER, TREES EIGHT INCHES DIAMETER BREAST HEIGHT AND OVER) OF 50-YEAR OLD, OVERSTOCKED, UNMANAGED STANDS OF SOUTHERN PINES

ADAPTED FROM U. S. DEPARTMENT OF AGRICULTURE MISC. PUBL. NO. 50

Table 5. Average site index for loblolly, shortleaf and longleaf pine on normal and moderately shallow phases of six soils. East Texas Timberlands (FC) Area.

Soils	Species	Soil Phases			
		Normal		Mod. Shallow	
		No. Plots Measured	Average Site Index in Feet	No. Plots Measured	Average Site Index in Feet
Annual Precipitation 44 inches and over					
Boswell fsl and vfsl	Loblolly	17	83	-- *	--
	Shortleaf	23	75	--	--
	Longleaf	3	77	--	--
Boswell gfsl and gvfsl	Loblolly	3	90	1	81
	Shortleaf	4	81	6	65
	Longleaf	--	--	--	--
Caddo fsl and vfsl	Loblolly	2	83	--	--
	Shortleaf	3	77	3	70
	Longleaf	2	75	1	70
Cuthbert fsl	Loblolly	2	81	2	70
	Shortleaf	4	75	2	64
	Longleaf	--	--	--	--
Kirvin gfsl	Loblolly	1	87	1	62
	Shortleaf	3	75	1	60
	Longleaf	--	--	1	59
Lakeland lfs	Loblolly	3	84	1	65
	Shortleaf	7	75	3	59
	Longleaf	3	72	--	--
Annual Precipitation less than 44 inches					
Boswell fsl	Loblolly	2	78	--	--
	Shortleaf	11	64	2	62
	Longleaf	--	--	--	--
Bowie fsl	Loblolly	2	82	--	--
	Shortleaf	5	73	1	66
	Longleaf	--	--	--	--
Cuthbert fsl	Loblolly	2	78	--	--
	Shortleaf	2	73	1	65
	Longleaf	--	--	--	--

* A dash (--) indicates that no measurements are available.

WOODLAND SUITABILITY GROUPINGS OF SOILS

All soils in each of the three study areas (FC, FCC, and CO) were rated to show relative capabilities, limitations and hazards in woodland uses. Soil-related items that were rated were: potential soil productivity for the three woodcrops - loblolly, shortleaf and longleaf pine; seedling mortality or regeneration potential; plant competition or brush encroachments; equipment limitations or trafficability; erosion hazards (Cooper, 1942); windthrow hazards (Grano, 1953); and hazards from Texas leaf cutting ants (Bennett, 1961) and gophers. Potential soil productivity was rated by measurements, or estimations, of average site index for each of the three pine species according to the procedures already discussed. The other items were rated largely on the basis of judgment of local, experienced soil scientists and woodland conservationists. Definitions and criteria for making these ratings are given in the Appendix. The rating criteria were designed to assist in making distinctions between different kinds and intensities of woodland conservation treatments that may need to be considered when using the soils as woodlands.

The soils have been placed into groups that are based on the ratings, and on a knowledge of the physical characteristics of each soil. These are called woodland suitability groupings of soils. Each group contains soils that (1) have about the same potential productivity (2) produce similar kinds of woodcrops, and (3) need similar management to produce these crops.

Information is summarized by woodland suitability groups in Tables 6, 7, and 8, and is further explained in the more detailed description of each group. Table 6 consists of the 19 groups of the FC portion of the East Texas Timberlands Resource Area. In Table 6, groups 1 through 10 are those that occur in the zone where average annual precipitation is 44 inches and greater, while groups 11 through 19 are those of the zone where average annual precipitation is less than 44 inches. Table 7 consists of nine groups in the Flatwoods (FCC) portion of the East Texas Timberlands Resource Area. Table 8 consists of summarized information for the Coast Prairie (CO) Area.

Summarized information in the tables, by groups consists of (1) generalized descriptions of the soils (2) site index values (3) ratings of hazards and limitations, and (4) suitable species.

A site index value was assigned to each woodland suitability group for each species of pine that was considered to be adapted. Any given index value is to the nearest 5-foot value of the weighted average, which was computed from the data in the appropriate table - 1, 2, or 3. For practical application, each value represents a central point of a ten-foot site index class. Where no data were available for a species, or where data were not adequate to supply a reasonable average site index, a value was supplied and marked by an asterisk (*). These supplied values were based on judgment, tempered by published research

results (Zahner, 1957, and others), and on a consideration of the site index relationships between soils and species that were reflected by data available.

Ratings of hazards and limitations, imposed by the soils on woodland use and management, have also been shown for each group in woodland suitability tables. These are shown in "adjective" form, such as slight, moderate, or severe. The significance of ratings to woodland use and management is pointed out in descriptions of the groups. In some groups, "wide-range" verbal ratings, such as slight to moderate, were used when a group of soils was not completely uniform for a given rating. In such cases, the explanations of soil characteristics are pointed out in the text for the specific soils that cause the "wide-range"ratings within a group. Possible treatments for moderate and severe problems are suggested.

A final column in the woodland suitability group tables is used for listing the important tree species or woodcrops that are suitable for each group of soils.

4-17609 Rev.3 -64

Table 6 WOODLAND SUITABILITY GROUPINGS OF SOILS FOR THE EAST TEXAS TIMBERLAND (FC) RESOURCE AREA (Flatwoods portion of this Resource Area is not included) Sheet 1 of 3

ANNUAL PRECIPITATION 44 INCHES AND ABOVE

Group No.	Generalized Description of Soils 1/	Average Site Index			Seedling Mortality	Plant Competition	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Pest Hazard	Suitable Species
		Lob. 2/	Short.	Long.							
1 - FC	Moderately coarse to medium textured, well drained to excessively drained upland soils with clayey subsoils; slowly to very slowly permeable; some have ferruginous gravel in the surface. Boswell fine sandy loam typifies this group.	80	75	75	Slight to Moderate	Mod.	Slight to Mod.	Mod. to Severe	Slight	Slight	Loblolly, Slash, Shortleaf, and Longleaf pines; Mixed upland oaks
2 - FC	Moderately shallow phases of slowly to very slowly permeable upland soils; they have restrictive layers of sandstone, iron cementation, or shale. Some have ferruginous gravel in the surface.	75	65	65	Moderate	Mod.	Slight to Mod.	Mod. to Severe	Mod.	Mod.	Shortleaf, Loblolly, and Longleaf pines.
3 - FC	Moderately sandy to medium textured, moderately to slowly permeable upland soils; good soil-moisture relations; typified by Bowie and Sawyer fine sandy loams.	85	75	75	Slight to Moderate	Mod.	Slight to Mod.	Slight to Mod.	Slight	Slight to Mod.	Loblolly, Slash, Shortleaf, and Longleaf pines; Mixed upland oaks.
4 - FC	Moderately sandy to fine textured, bottom land soils; moderately well to poorly drained; occasionally to frequently flooded; watertable provides moisture throughout year. Typified by Iuka series.	105	95 * 3/	- 4/	Slight to Severe	Severe	Severe	None to Slight	Slight	Slight	Loblolly, Slash, Shortleaf pines; Southern hardwoods.
5 - FC	Poorly drained and frequently flooded, mostly slowly permeable bottom land soils that remain inundated for long periods. Typified by Bibb series.	These very slowly permeable soils are poorly drained and subject to frequent damaging overflows which remain on the land for considerable periods. These are bottom land hardwood sites generally not suited to the establishment of southern pines unless the water problem is corrected.									Southern hardwoods; Cypress; Tupelo gum.
6 - FC	Poorly drained, level, very slowly permeable, mostly medium and fine textured soils of upland "flats". Typified by the Byars series.	80	75 *	-	Moderate to Severe	Mod.	Severe	None in level areas, slight on B slopes	Mod.	Slight	Loblolly, Slash, and Shortleaf pines; Southern hardwoods.

1/ The narrative for each group lists all of the soils that are included.

2/ Until information is available it is assumed that these values for loblolly pine represent a close approximation for slash pine.

3/ Values marked by an asterisk (*) have been assigned or adjusted (see text).

4/ Where a dash (-) is shown, no data is available. The species concerned is not generally found on the soils.

Table 6 WOODLAND SUITABILITY GROUPINGS OF SOILS FOR THE EAST TEXAS TIMBERLAND (FC) RESOURCE AREA
(Flatwoods portion of this Resource Area is not included)

ANNUAL PRECIPITATION 44 INCHES AND ABOVE

Group No.	Generalized Description of Soils[1]	Average Site Index			Seedling Mortality	Plant Competition	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Pest Hazard	Suitable Species
		Lob.[2]	Short.	Long.							
7 - FC	Moderately coarse to medium textured, upland soils with thick A horizons; moderately permeable. Typified by Bowie loamy fine sand.	90	80	80	Slight to Moderate	Mod. to Severe	Slight to Mod.	Slight to Mod.	Slight	Slight to Mod.	Loblolly, Slash, Shortleaf, and Longleaf pines; Mixed upland oaks.
8 - FC	Coarse textured, mostly rapidly permeable, upland soils; typified by the Lakeland series.	80	75	75	Moderate to Severe	Slight to Mod.	Slight to Mod.	Slight to Severe	Slight	Mod. to Severe	Loblolly, Longleaf, and Shortleaf pines.
9 - FC	Imperfectly drained, moderately coarse and medium textured, mostly level, moderately to slowly permeable soils. Typified by the Caddo series.	85	75	75	Slight to Moderate	Severe	Severe	None to Slight	Slight	Slight	Loblolly, Slash, Longleaf, and Shortleaf pines; Southern hardwoods.
10 - FC	Deep beds of sands, and moderately shallow phases of sands; and Lakeland loamy fine sand, moderately shallow phase.	70 *	65	65 *	Severe	Mod. to Severe	Slight to Mod.	None to Mod.	Slight to Mod.	Severe	Longleaf, Shortleaf, and Loblolly pines.

ANNUAL PRECIPITATION LESS THAN 44 INCHES[5]

11 - FC	Moderately coarse to medium textured, well drained to excessively drained upland soils with clayey subsoils; slowly to very slowly permeable; some have ferruginous gravel in the surface. Boswell fine sandy loam typifies this group. These are the same soils as in Group 1. This group is separated from Group 1 because of lower annual precipitation.	70 *	65	-	Slight to Moderate	Mod.	Slight to Mod.	Mod. to Severe	Slight	Slight	Shortleaf and Loblolly pines.
12 - FC	Moderately shallow phases of slowly to very slowly permeable upland soils; they have restrictive layers of sandstone, iron cementation, or shale. Some have ferruginous gravel in the surface. These are the same soils as in Group 2. This group is separated from Group 2 because of lower annual precipitation.	-	65	-	Moderate	Mod.	Slight to Mod.	Mod. to Severe	Mod.	Mod.	Shortleaf pines.

4-17609 Rev. 3-64

ANNUAL PRECIPITATION LESS THAN 44 INCHES

Group No.	Generalized Description of Soils[1/]	Average Site Index			Seedling Mortality	Plant Competition	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Pest Hazard	Suitable Species
		Lob.[2/]	Short.	Long							
13 - FC	Moderately sandy to medium textured, moderately to slowly permeable upland soils; good soil-moisture relations; typified by Bowie and Sawyer series. These are the same soils as in Group 3. This group is separated from Group 3 because of lower annual precipitation.	80	70	-	Slight to Moderate	Mod.	Slight to Mod.	Slight to Mod.	Slight	Slight to Mod.	Loblolly, Slash, and Shortleaf pines; Mixed upland oaks.
14 - FC	Moderately sandy to fine textured, bottom land soils; moderately well to poorly drained; occasionally to frequently flooded; watertable provides moisture throughout year. Typified by Iuka series. These are the same soils as in Group 4. This group is separated from Group 4 because of lower annual precipitation.	100	90	-	Slight to Severe	Severe	Severe	None to Slight	Slight	Slight	Loblolly, Slash and Shortleaf pines; Southern hardwoods
15 - FC	Moderately coarse to medium textured, upland soils with thick A horizons; moderately permeable. Typified by Bowie loamy fine sand. These are the same soils as in Group 7. This group is separated from Group 7 because of lower annual precipitation.	80 *	75	-	Slight to Moderate	Mod.	Slight to Mod.	Slight to Mod.	Slight	Slight to Mod.	Loblolly, Slash, and Shortleaf pines; Mixed upland oaks.
16 - FC	Coarse textured, mostly rapidly permeable, upland soils; typified by the Lakeland series. These are the same soils as in Group 8. This group is separated from Group 8 because of the lower annual precipitation.	70	65	-	Moderate to Severe	Slight to Mod.	Slight to Mod.	Slight to Severe	Slight	Mod. to Severe	Shortleaf and Loblolly pines.
17 - FC	Imperfectly drained, moderately coarse and medium textured, mostly level, moderately to slowly permeable soils. Typified by the Caddo series. These are the same soils as in Group 9. This group is separated from Group 9 because of lower annual precipitation.	80 *	75	-	Slight to Moderate	Severe	Severe	None to Slight	Slight	Slight	Loblolly, Slash, and Shortleaf pines; Southern hardwoods.
18 - FC	Deep beds of sands, and moderately shallow phases of sands; typified by Lakeland fine sand, very deep phase, and Lakeland loamy fine sand, moderately shallow phase. These are the same soils as in Group 10. This group is separated from Group 10 because of lower annual precipitation.	55 *	55	-	Severe	Mod. to Severe	Slight to Mod.	None to Mod.	Slight	Severe	Shortleaf pine.
19 - FC	Poorly drained, level, very slowly permeable, mostly medium and fine textured soils of upland "flats". Typified by the Byars series. These are the same soils as in Group 6. This group is separated from Group 6 because of lower annual precipitation.	75 *	70	-	Severe	Mod.	Severe	None to Slight	Mod.	Slight	Shortleaf, and Loblolly pines; Mixed upland oaks.

Woodland Suitability Group 1 - FC

The soils of this group are mostly fine and very fine sandy loams. They are very slowly permeable, except the Cuthbert soils, which are slowly permeable and are only moderately deep and droughty. These soils are moderately well drained to excessively drained. A few have significant amounts of iron ore and fragmentary gravel, especially in the surface layers. A few of the soils are stony. They occupy erosional upland that is gently undulating to hilly, although the major areas are rolling. Slopes range from about 1 to 20 percent, but dominantly are about 3 to 15 percent. Surfaces are mostly convex and plane:

The soils in this group are:

Boswell fine sandy loam
Boswell very fine sandy loam
Boswell gravelly fine sandy loam
Boswell gravelly very fine sandy loam
Boswell sandy clay loam, severely eroded
Boswell clay, severely eroded
Boswell stony fine sandy loam
Cuthbert fine sandy loam
Cuthbert gravelly fine sandy loam
Cuthbert gravelly sandy loam
Cuthbert stony fine sandy loam
Susquehanna fine sandy loam
Susquehanna very fine sandy loam
Susquehanna fine sandy loam, thick surface
Susquehanna sandy clay loam, severely eroded

Site indexes for loblolly, shortleaf and longleaf pines on these soils are 80, 75, and 75, respectively. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 425, 440, and 285 board feet (Scribner, Fig. 8) for loblolly, shortleaf and longleaf pine, respectively.

Loss of naturally occurring or planted seedlings of the three pine species during the first season varies from moderate on Susquehanna fine sandy loam, thick surface and Cuthbert fine sandy loam, to slight on the other soils in the group. The moderate problem is due to thickness of sandy surface soil, which has low moisture holding capacity and may cause seedlings to wilt permanently before their roots grow into the moisture-supplying clayey layers in the profile. Such losses may be over 50% during an unusually droughty season, and replanting usually is needed to obtain adequate stocking. Under normal weather conditions in managed stands, the other soils in this group will become adequately stocked by natural reseeding.

This group of soils generally is favorable to plant growth. For that reason moderate plant competition may develop between the desired pine species and undesirable plants when the canopy is opened or removed for regeneration

purposes. Establishment occurs, but initial growth rate may be retarded to the extent that development of a fully stocked stand is delayed. Some site preparation such as girdling, use of chemicals, and prescription burning, may be advisable to prevent delay in establishment of an adequate stand.

The equipment limitations of soils in this group range from slight to moderate. Because of very slowly permeable, plastic clay subsoils usually at shallow depths in the profile in the Boswell and Susquehanna soils, there are periods during high rainfall seasons of late winter and early spring when the operation of equipment is limited. If equipment is used during this period, usually less than three months, damage to tree roots occurs, and operation of equipment is difficult. The Cuthbert soils occupy more rolling relief, have less clay in the subsoil, and cause no special problems in equipment operations due to wetness during any time of the year. The more steeply sloping areas of soils of this group have moderate equipment limitations, and careful planning is needed in constructing and maintaining roads.

The erosion hazard on the soils in this group is moderate on slopes of less than 8 percent and severe on slopes greater than 8 percent. This is due to very slow or slow internal drainage, which causes rapid runoff from steeper slopes. Roads and skid trails should be located along ridge tops or approximately on the contour to prevent the accumulation of water that causes gullies. Where this is not practical, the installation of such water-control measures as water bars should be considered to prevent soil damage. Careful preservation of vegetative litter by protection from loss by wild fires, particularly on the more sloping areas is another conservation measure that helps to control erosion.

Woodland Suitability Group 2 - FC

This group consists of moderately shallow phases of slowly and very slowly permeable soils, which have restrictive layers of sandstone, iron pan, shale or other impermeable material, usually beginning at depths of 20 to 40 inches, but which may begin at depths of 40 to 50 inches (Fig. 9). Also included in this group are some steeply sloping, gravelly and stony soils, on which rainfall is less effective than on the other phases of the soil series. The above described soil characteristics limit root penetration and available moisture storage, which cause trees to be affected by drought. Slopes range from about 1 to 40 percent, but dominantly are about 3 to 20 percent. Some Bub and Cuthbert soils have slopes that exceed 20 percent.

Figure 9. Profile of Cuthbert gravelly sandy loam, moderately shallow over an ironstone layer that restricts penetration of pine tree roots.

The soils in this group are:

Boswell fine sandy loam, moderately shallow
Boswell gravelly fine sandy loam, moderately shallow
Boswell gravelly very fine sandy loam, moderately shallow
Bub gravelly fine sandy loam
Bub gravelly loam
Bub stony loam
Caddo fine sandy loam, moderately shallow
Conroe gravelly fine sandy loam
Conroe gravelly loamy fine sand
Cuthbert fine sandy loam, moderately shallow
Cuthbert gravelly sandy loam, moderately shallow
Cuthbert stony fine sandy loam
Kirvin fine sandy loam, moderately shallow
Kirvin gravelly fine sandy loam, moderately shallow
Nacogdoches clay loam
Nacogdoches gravelly clay loam
Nacogdoches gravelly fine sandy loam

Site index for this group of soils is 75 for loblolly, 65 for shortleaf and 65 for longleaf pine. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth of about 360, 280, and 170 board feet (Scribner, Fig. 8) for loblolly, shortleaf and longleaf pine, respectively.

The mortality of both planted and naturally occurring seedlings is considered to be moderate for the soils of this group due to the limited available moisture and to the difficulty of doing a good job of planting on the more gravelly and stony soils. The problem may be severe on the more shallow gravelly ridges. Losses between 25 and 50 percent of seedlings can be expected from soil influences. Some replanting to fill in openings usually is needed, and natural regeneration cannot always be relied on for adequate restocking.

Plant competition of undesirable species is considered to be moderate on these soils when openings are made in the canopy. Establishment of desired species may be delayed, thereby preventing the development of a fully stocked stand unless management practices, such as girdling, prescription burning, or chemicals, are used to control the competing vegetation.

Equipment limitation due to wetness is no particular problem on these droughty, moderately shallow, and mostly gravelly soils. There is a moderate equipment limitation on the steeply sloping, and on the stony soils of the group. Type of tree planting equipment used, and location and maintenance of roads, skid trails and landings are affected by these conditions.

The erosion hazard of the soils of this group, when managed according to acceptable standards, varies from moderate on the more gently sloping and more gravelly soils to severe on the less gravelly, steeply sloping soils. Careful planning of location, construction and maintenance of roads, trails and landings, as well as management of forest litter, are needed to control erosion on the steeper slopes.

The soils of this group are considered to have a moderate windthrow hazard. This is a result of shallow penetration of the taproots, which is caused by restrictive layers in the soils (Fig. 10). Some windthrow can be expected during periods of great wind velocity or when trees are heavy with ice (glaze) while the soils are saturated, particularly if stands are thin and on exposed ridge tops.

The pest hazard is considered to be moderate on the soils of this group. Limited available moisture supplied by the soils causes trees to be weakened during extended periods of drought and more susceptible to Ips beetle damage. Shortleaf pine, which is quite susceptible to tip moth damage, is the dominant pine species on most of these soils.

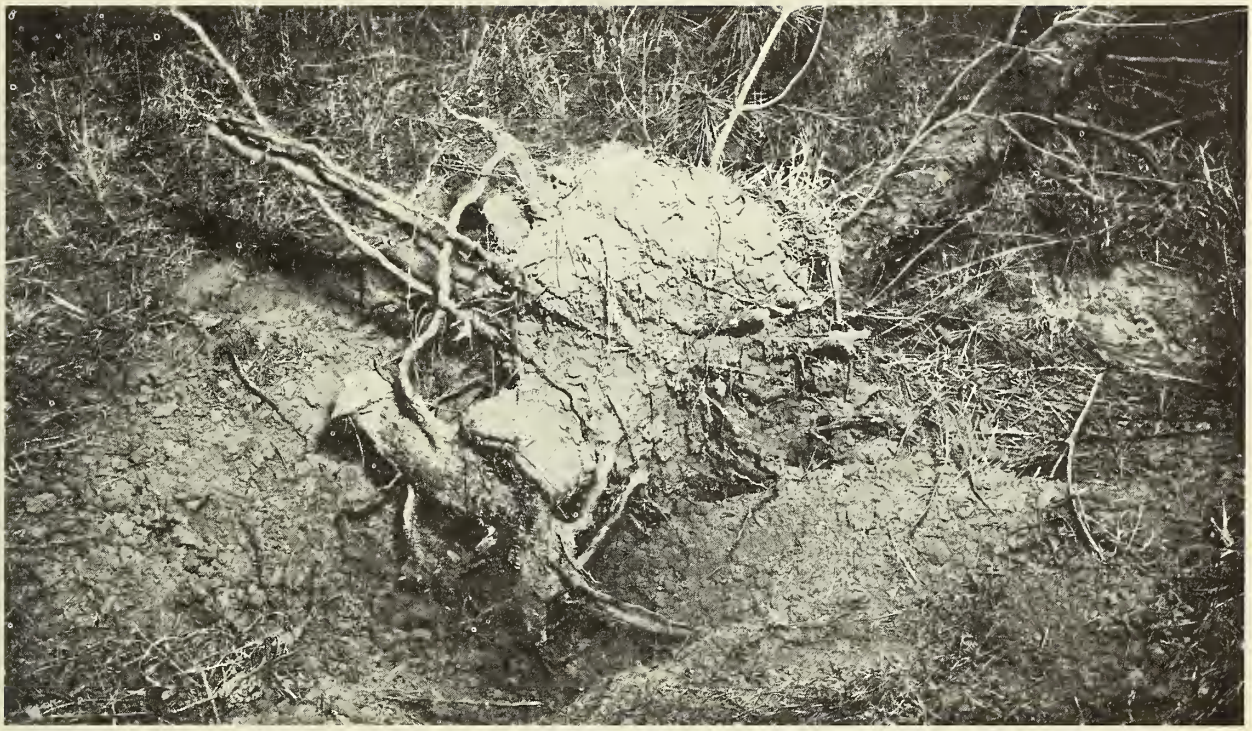


Figure 10. Windthrow resulting from restrictive rooting of pine on shallow soils of Conroe Series.

Woodland Suitability Group 3 - FC

The soils of this group are mostly fine and very fine sandy loams. They are slowly permeable, except the Bowie, Ruston and Magnolia soils, which differ in being moderately permeable. All of the soils store rather high amounts of available moisture, which makes them productive for pine timber (Fig. 11). Slopes range from 0 to about 12 percent, and dominantly are less than 8 percent. The soils are well drained to moderately well drained.

Figure 11. Established pine seedlings on Kirvin fine sandy loam, eroded (Woodland Suitability Group 3). Wood crops grow well on eroded soils, after establishment.

The soils in this group are:

Alto fine sandy loam
Bowie fine sandy loam
Bowie very fine sandy loam
Kirvin fine sandy loam
Kirvin gravelly fine sandy loam
Kirvin very fine sandy loam
Magnolia fine sandy loam
Muskogee very fine sandy loam
Muskogee very fine sandy loam, thick surface phase
Nacogdoches fine sandy loam
Ruston fine sandy loam
Sawyer fine sandy loam
Sawyer fine sandy loam, thick surface phase
Sawyer very fine sandy loam

Site index is 85 for loblolly, 75 for shortleaf and 75 for longleaf pine on the soils. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 490, 435 and 285 board feet (Scribner, Fig. 8) for loblolly, shortleaf, and longleaf pine, respectively.

Only two soils of the group, the thick surfaced phases of Muskogee very fine sandy loam and Sawyer fine sandy loam, can be expected to have moderate seedling mortality. This is due to the low moisture holding capacity of their thick surface soils, which may cause loss of seedlings during periods of drought. Normally, losses of 25-50 percent of seedlings can be expected, and some replanting will be needed to fill in openings on these thick-surfaced soils.

Since these soils usually supply rather large amounts of available moisture, many competing plants grow on them, and plant competition for the desired species is considered moderate. Plant competition will not ordinarily prevent adequate stand establishment, but may retard initial growth and delay the development of a fully stocked stand, unless management practices, such as girdling, prescription burning, or chemicals, are used to control the competing vegetation.

The equipment limitations are slight on the well drained Kirvin, Magnolia, Nacogdoches, Ruston and most areas of the Bowie soils. The problem is moderate on the more nearly level, moderately well drained Alto, Muskogee, Sawyer, and the more moist areas of the Bowie soils. Some difficulty in logging and damage to tree roots from equipment can be expected during a period of up to about three months during winter and spring.

When managed according to currently acceptable standards, the gently sloping areas of these soils have only a slight erosion hazard. The more rolling areas, particularly of Magnolia, Kirvin, and Bowie soils, have a moderate erosion hazard. This requires erosion prevention measures, such as good planning of location and maintenance of roads, trails and landings.

Roads and trails should be built along ridgetops and on the contour to prevent water concentration.

Soil associated woodland pests pose a slight to moderate problem on these soils. Gophers may, unless controlled, do moderate damage to seedlings the first few years on the thick-surface phases and on more permeable soils, especially Bowie soils, in and near old fields. Leaf-cutting ants (Bennett, 1961) may cause moderate damage on the thicker surfaced, more permeable, better drained soils, particularly when the soils are adjoining areas of coarse textured soils.

Woodland Suitability Group 4 - FC

The soils of this group are fine sandy loams to clay loams in texture, and they are permeable, well drained to poorly drained bottom land soils. Practically all areas are at least occasionally flooded, and most soil areas are subject to frequent flooding. All have fluctuating water tables. In the Bibb soils the water tables are at or near the surface during the cool moist season and usually are about 4 to 10 feet below the surface during the late part of the summer. Water tables in the other soils vary from about 2 to 4 feet below the surface in the cool moist season to about 6 to 15 feet below the surface in the drier months. These soils are quite productive for pine timbers if stands are obtained, because the available soil moisture is adequate.

The soils in this group are:

Bibb clay loam
Bibb fine sandy loam
Bibb very fine sandy loam
Bibb silty clay loam
Hannahatchee clay loam
Hannahatchee fine sandy loam
Iuka clay loam
Iuka clay loam, clay substratum variant
Iuka clay loam, imperfectly drained
Iuka fine sandy loam
Iuka fine sandy loam, clay substratum variant
Iuka very fine sandy loam
Iuka very fine sandy loam, clay substratum variant
Ochlockonee clay loam
Ochlockonee fine sandy loam

Site index is 105 for loblolly and 95 for shortleaf pine. For over-stocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 775 board feet for loblolly and 725 board feet for shortleaf pine (Scribner, Fig. 8). Longleaf pine does not ordinarily occur on these soils, and no stand adequate for measurement of site index was found. Loblolly is the dominant pine species on these soils. Desirable hardwood species occur on these soils, and consideration should be given to management of adapted hardwood species in combination with pine.

Seedling mortality ranges from slight to severe on these soils, and mortality is due largely to flooding. The greater the frequency, duration, and depth of inundation the more severe is the problem. Failure of seed to germinate and mortality of seedlings is particularly severe on the poorly drained Bibb soils where water stands for long periods during the rainy season. Natural regeneration usually is not reliable on the Bibb soils or on Iuka and Hanahatchee soils in flood plains of low gradient where overflow water remains for long periods. Water control may be necessary in some cases before stands can be established, even by planting. Seedling mortality is only slight on Ochlockonee soils.

Plant competition for the desired species is severe when openings are made in the canopy, due to the high available moisture in these soils. Some tree planting may be necessary, because natural regeneration cannot be relied on to provide adequate restocking of the pine. Natural regeneration usually is satisfactory on the hardwoods. Site preparation treatments are necessary, such as the use of chemicals, girdling, and prescription burning of undesirable plants.

Equipment limitations are severe on these bottom land soils, because of high water tables, and the soils being saturated for more than about three months of the year. The problem is particularly great on the poorly drained Bibb and clay substratum phases of Iuka soils, which may occur in association with the better drained Ochlockonee, Iuka or Hannahatchee soils, and in such areas the more poorly drained soils must be crossed in logging operations. Use of equipment during the cool, moist season is difficult, and may cause serious damage to tree roots and soil structure.

Some windthrow may occur during glaze (ice) storms when the trees are heavier than normal with ice coatings.

Woodland Suitability Group 5 - FC

These poorly drained, very slowly permeable bottom land soils are very fine sandy loam to clay in texture. The soils are subject to frequent damaging floods, and they may be inundated for considerable periods.

The soils in this group are:

Bibb-like clay
Bibb fine sandy loam, clay substratum variant
Bibb silt loam, clay substratum variant
Bibb very fine sandy loam, clay substratum variant

The poor surface and internal drainage of these bottom land soils, plus the length of flood periods, results in severe seedling mortality and normally prevents stocking with pine timber. No suitable stands of pine for sampling were found on these soils. They usually support a stand of water tolerate hardwoods, largely water oak and willow oak. These soils generally are not suited to the establishment of southern pines, unless the water problem is corrected. They may be best managed for hardwood production.

Equipment limitation is severe on these soils. Logging operations are limited to dry periods, because the soils are saturated with water during the cool, moist season.

There is a moderate problem of windthrow, due to shallow root systems and poor soil stability during the long period the soils are saturated with water. This should be taken into consideration in planning density control in harvest operations.

Woodland Suitability Group 6 - FC

This group consists of poorly to imperfectly drained soils that are fine sandy loam to clay in texture. They have very slowly to slowly permeable clayey subsoils. The soils occupy upland "flats".

The soils in the group are:

Byars clay loam
Byars fine sandy loam
Byars very fine sandy loam
Garner clay
Rains very fine sandy loam
Wrightsville silt loam
Wrightsville very fine sandy loam

The very slowly permeable clayey subsoils, with their low capillary pore space, and the level to depressed relief cause the soils to be wet natured in the cool rainy season and to be rather droughty in dry seasons. The flat to nearly level relief of the soil areas, the rather high rainfall of the area, and the deep feeding for moisture by the pine species, apparently accounts for the favorable site index on these soils.

Site index is 80 for loblolly and 75 for shortleaf on these soils. Longleaf pine usually does not grow on these soils, and no stand suitable for sampling was located. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 425 board feet for loblolly and 435 board feet for shortleaf pine (Scribner, Fig. 8).

Mortality of naturally occurring pine seedlings is considered to be severe on Byars, Rains and Wrightsville soils, because of their poor drainage. Severe seedling mortality of 50 to 100 percent can be expected on the poorly drained soils, and natural regeneration cannot be relied on unless surface drainage is provided. Planted seedling mortality is considered moderate (25-50 percent) on these soils and the need for some replanting to fill in openings can be expected. Natural seedling mortality of 25 to 50 percent can be expected on the Garner soils. Some planting, water control, and seedbed preparation may be helpful in restocking.

Moderate plant competition can be expected on all these soils, and particularly on Garner clay. This will retard but not usually prevent natural regeneration of the desired species. Some management practices, such as girdling, use of chemicals, or prescription burning may be needed to control the competing vegetation in areas of abundant seed source.

Equipment limitation is severe on all these soils, because they are poorly to imperfectly drained, and have clayey subsoils. Logging usually should be restricted for a period greater than 3 months of the cool, moist season, because of danger of damage to roots and soil.

Windthrow is a moderate problem. The shallow root system on these poorly drained soils may cause considerable windthrow during periods of high wind velocity while the soils are saturated. Density control (a greater than normal stand density to be maintained) in intermediate and harvest cutting operations is needed to cope with this hazard.

Woodland Suitability Group 7 - FC

The soils of this group have loamy fine sands and thicker than normal fine sandy loam surface layers. They are moderately to slowly permeable and well drained to moderately well drained. Some occupy nearly level, stream terrace positions, and all of the soils have plentiful available moisture. Ochlockonee loamy fine sand is the only bottom land soil in the group. Slopes are 1 to about 12 percent on the Bowie and Ruston loamy fine sands.

The soils in the group are:

Bowie fine sandy loam, terrace phase
Bowie fine sandy loam, thick surface phase
Bowie loamy fine sand
Bowie very fine sandy loam, thick surface phase
Klej fine sand
Klej loamy fine sand
Magnolia fine sandy loam, terrace phase
Ochlockonee loamy fine sand
Ruston fine sandy loam, terrace phase
Ruston fine sandy loam, thick surface phase
Ruston loamy fine sand
Ruston loamy fine sand, terrace phase
Sawyer fine sandy loam, terrace phase
Sawyer loamy fine sand

Site index is 90 for loblolly, 80 for shortleaf, and 80 for longleaf pine. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 555, 500, and 350 board feet (Scribner, Fig.8) for loblolly, shortleaf, and longleaf pine, respectively.

Seedling mortality is slight on Bowie, Sawyer, Magnolia and Ruston fine sandy loams. Adequate natural regeneration and satisfactory restocking with initial planting can be expected on these soils, since expected seedling mortality is less than 25 percent. The thick surface phase soils and the loamy fine sands have a moderate seedling mortality problem due to low moisture holding capacity. Losses of about 25 to 50 percent of seedlings can be expected on these soils. Some replanting to fill in openings can be expected.

The problem of plant competition is moderate on most soils of this group and is severe on some of the more moist soils, such as the terrace phase soils and the Klej soils. Since these soils supply rather large amounts of available moisture, considerable competing vegetation is usually present when openings are made in the canopy, and this may delay development of a fully stocked stand unless competing vegetation is controlled. Practices such as girdling, use of chemicals, or prescription burning may be needed.

Equipment limitations are moderate on the more level and moist areas of the moderately well drained Bowie, Sawyer, Ochlockonee, and Klej soils. Logging operations will usually be restricted for periods up to three months during the rainy season, because the soils usually are near saturation and there is a danger of root and soil damage by equipment.

There is a moderate erosion hazard on the more sloping to hilly areas of Bowie and Ruston loamy fine sands. The thick surface phases and loamy fine sands are particularly susceptible to gullying where water is concentrated. Care should be exercised to lay out roads and trails on ridge tops where practical, provide water bars and turnouts where needed, and maintain roads to control erosion. Erosion hazard is slight where slopes are less than about 5 percent.

The soil associated woodland pest problem is only slight on the fine sandy loams and the Ochlockonee loamy fine sands, particularly in virgin areas not associated with old fields. Gophers and leaf-cutting ants (Bennett, 1961) pose a moderate problem on the thick surfaced phases and the loamy fine sands of the group. The gophers usually are more prevalent on and adjacent to old fields. Some replanting and pest control will probably be needed to obtain a fully stocked stand.

Woodland Suitability Group 8 - FC

These are loamy fine sands and fine sands that have rapidly to slowly permeable subsoils. Slopes range from 0 to about 20 percent, and dominantly are about 2 to 15 percent.

The soils in the group are:

Boswell loamy fine sand
Cuthbert loamy fine sand
Eustis fine sand
Eustis loamy fine sand
Eustis loamy fine sand, terrace phase
Kirvin loamy fine sand
Lakeland fine sand
Lakeland loamy fine sand
Susquehanna loamy fine sand

These soils are droughty for young pine seedlings, due to the thick sandy surface soils, but they have higher moisture supplying sandy clay loam to clay subsoils within the reach of tree roots. Depth to clayey subsoils of the Boswell, Cuthbert, Kirvin, and Susquehanna loamy fine sands is within 36 inches of the surface. In the other soils of the group the less sandy subsoil or substratum is encountered within 72 inches. These soils have rapid intake rates and a large percent of the water in the soil is available to plants.

Site index is 80 for loblolly, 75 for shortleaf, and 75 for longleaf pine. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 425, 435, and 285 board feet (Scribner, Fig. 8) for loblolly, shortleaf and longleaf pine, respectively.

Seedling mortality is moderate on the Boswell, Cuthbert, Kirvin, and Susquehanna loamy fine sands. A loss of 25 to 50 percent of seedlings can be expected on these soils, and some replanting will usually be needed. Natural regeneration cannot always be relied on for restocking. Seedling mortality is severe on the other soils of the group. Losses of planted stock usually are over 50 percent on the Lakeland and Eustis soils. On most areas of the deeper sandy soils, seedbed preparation, use of good quality, well developed seedlings, considerable replanting, and superior planting techniques are necessary to secure adequate restocking.

Plant competition usually is only slight on the Boswell, Cuthbert, Eustis, Kirvin and Lakeland soils. On the Eustis loamy fine sand, terrace phase, and Susquehanna soils, competing vegetation is a moderate problem, because they are high moisture supplying soils. Initial growth of pine seedlings may be slowed and development of an adequate stand may be delayed, unless management techniques such as girdling, prescription burning or chemicals, are used to control the competing plants.

Equipment limitations are slight on the undulating to sloping areas of the Boswell, Cuthbert, Kirvin and Susquehanna loamy fine sands. The problem of equipment limitations is moderate on the rolling to steep areas of Boswell, Cuthbert, Kirvin, and Susquehanna, and on all areas of the other soils of the group. This problem is due to the poor traction provided by these loose, coarse textured soils during dry weather, and

to some lack of stability on the more moist areas of the Susquehanna loamy fine sands during rainy seasons. Care must be exercised in location and maintenance of roads and in following the contour with mechanical planting equipment where this problem exists.

The erosion hazard is slight to moderate on the less sloping areas, and severe on the rolling to hilly areas, due largely to the tendency of these soils to develop gullies where water is concentrated. Care should be exercised to lay out roads and trails on ridge tops where possible, and to provide water bars and turnouts where needed. Careful maintenance of roads should be provided.

The soil associated woodland pests, leaf-cutting ants (Bennett, 1963) and particularly gophers, are apt to cause severe damage on the deep sands (Lakeland and Eustis, Fig. 12). Pests are apt to cause moderate damage on the Boswell, Cuthbert, Kirvin, and Susquehanna soils, particularly on or adjacent to old fields. Eradication of pests before planting is advisable.

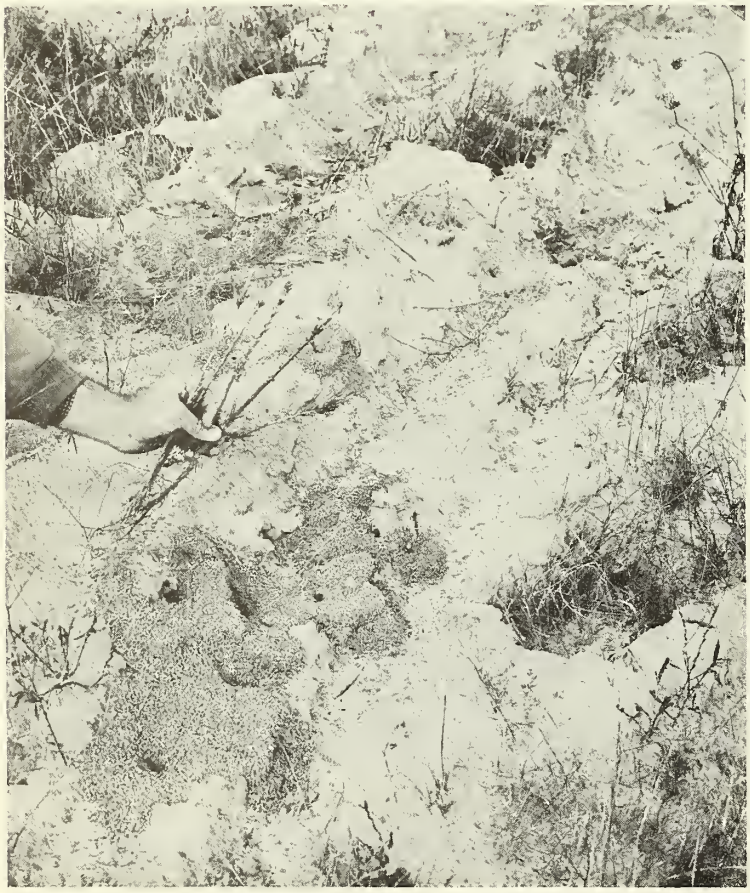


Figure 12. Pine seedlings destroyed by Texas leaf-cutting ants. These forest insects are found on well-drained, deep sandy soils, such as Lakeland and Eustis. fine sands.

Woodland Suitability Group 9 - FC

These are imperfectly and poorly drained soils of very fine sandy loam to loamy fine sand texture, and with moderately to very slowly permeable subsoils or substrata.

The soils in the group are:

Byars very fine sandy loam, thick surface phase
Caddo fine sandy loam
Caddo fine sandy loam, clayey substratum variant
Caddo fine sandy loam, thick surface phase
Caddo loamy fine sand
Caddo loamy fine sand, clayey substratum variant
Caddo very fine sandy loam
Caddo very fine sandy loam, thick surface phase
Caddo very fine sandy loam, clayey substratum variant
Plummer loamy fine sand
Plummer loamy fine sand, clay substratum variant
Rains-like fine sandy loam
Rains-like fine sandy loam, clay substratum variant

The Byars very fine sandy loam, thick surface phase, the Rains-like soils, and the Plummmer soils are poorly drained. Caddo soils are imperfectly drained. The two Rains-like fine sandy loams and Plummer loamy fine sand, clay substratum variant, are field names for uncorrelated soils. All of the soils of this group supply large amounts of available moisture and are quite productive for pine timber.

Site index is 85 for loblolly, 75 for shortleaf, and 75 for longleaf pine. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of 490, 435, and 285 board feet (Scribner, Fig. 8) for loblolly, shortleaf, and longleaf pine, respectively.

Seedling mortality is considered to be moderate due to the low moisture holding capacity of the thick surface layers of Caddo and Plummer, and because of the poor drainage in all except Caddo soils. The problem may be severe on very poorly drained or ponded phases of Byars and Rains-like soils. A loss of 25 to 50 percent of seedlings can be expected where the problem is moderate, and some replanting usually will be needed. Natural regeneration cannot always be relied on for restocking. Seedling mortality is slight on Caddo fine sandy loam with usual losses of less than 25 percent.

The degree of plant competition on these high moisture supplying soils is severe where seed sources of competing vegetation are present. Natural regeneration cannot be relied on to provide adequate restocking of pine species. Special site preparation treatment such as girdling, use of chemicals, or prescription burning, usually is necessary. Replanting may be needed.

Equipment limitations are severe on these soils. Difficulty in logging and damage to tree roots and the soil can be expected for a period of about three months during the cool, moist season.

Woodland Suitability Group 10 - FC

These are very droughty fine sands and loamy fine sands that are limited in their storage of available moisture. The soils are all excessively drained. Slopes range from 0 to about 20 percent.

The soils in the group are:

Lakeland fine sand, very deep phase
Lakeland loamy fine sand, moderately shallow phase
Ruston loamy fine sand, moderately shallow phase

The Lakeland fine sand, very deep phase, is deeper than 72 inches to less sandy material, and the soil has limited moisture supply, especially during dry periods. The moderately shallow phases of Lakeland and Ruston loamy fine sands are underlain by sandstone or moderately to strongly cemented layers beginning at depths of 20 to 50 inches, but usually beginning between 30 and 40 inches. Such layers severely limit moisture and restrict tree root penetration. The drought-resistant shortleaf and longleaf species are more prevalent on all these soils than is loblolly pine. A scrubby and often sparse growth of sandjack and blackjack oak are the dominant associated species on these droughty sands.

Site index of the stands sampled on these soils is 70 for loblolly, 65 for shortleaf, and 65 for longleaf pine. Few stands suitable for sampling were found on the very deep phases. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 300, 280, and 170 board feet (Scribner, Fig. 8) for loblolly, shortleaf, and longleaf pine, respectively. Site indexes of individual trees measured on the very deep, more excessively drained sands indicate that the site index may be as much as 10 feet lower than that shown.

Seedling mortality generally is severe, because the soils do not hold enough moisture during the dry season of the year (Fig. 13). Expected losses due to soil influences usually are over 50 percent and may approach 100 percent on the more excessively drained, very deep phase of Lakeland. Natural regeneration cannot be relied on. Planting, preferably during a cycle of higher rainfall, with considerable replanting, special seedbed preparation, superior planting techniques and use of best quality seedlings, is needed to assure adequate restocking.

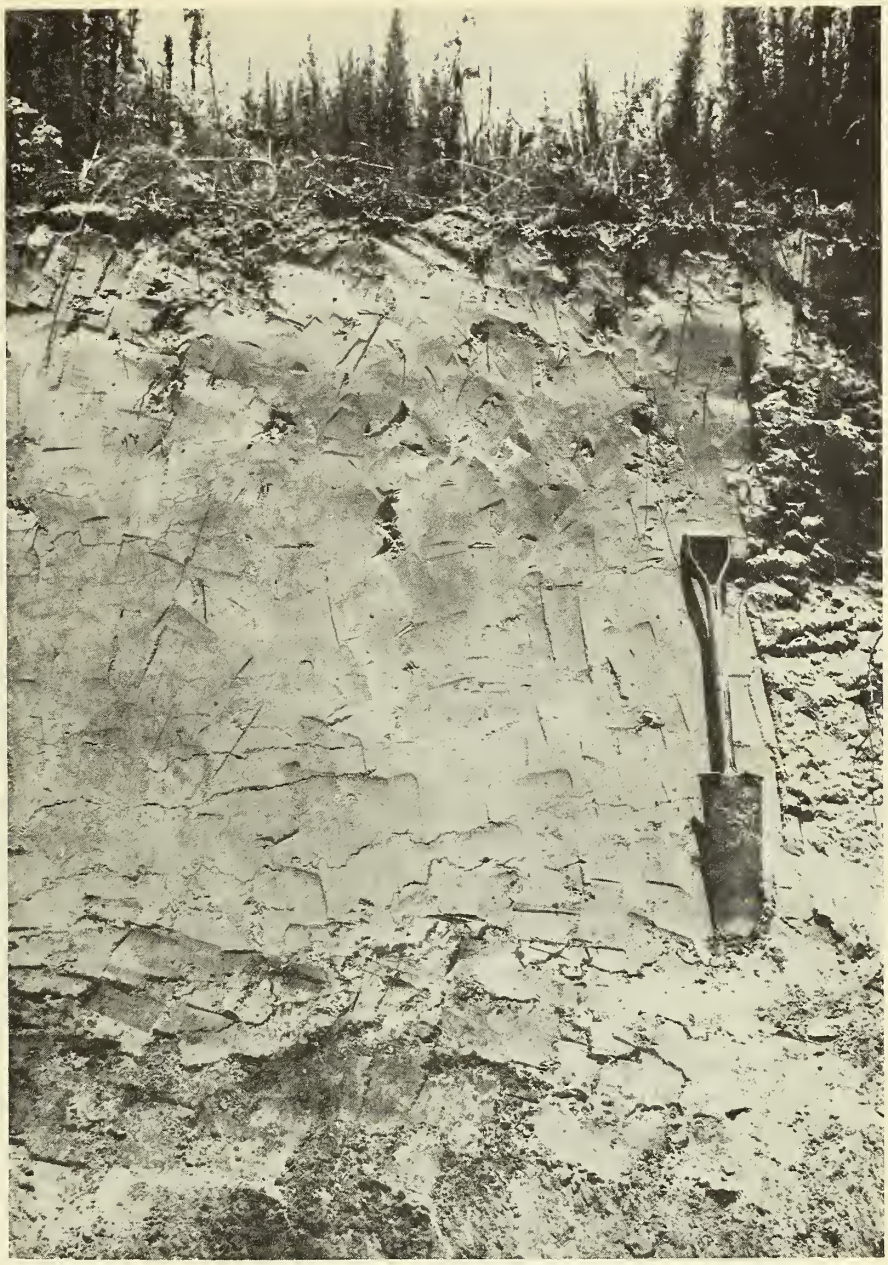


Figure 13. Soil profile of Lakeland fine sand, very deep phase. Coarse textured rapidly permeable soil, which has low moisture-holding capacity, resulting in problem of seedling mortality.

The degree of plant competition following removal of overstory is considered moderate to severe. The amount of competing vegetation is small compared with that of more moist sites, but the amount of moisture available for seedlings is so low during dry periods that even this amount of competition is considered a moderate problem. Some seedbed preparation usually is needed to provide restocking of recommended planted seedlings. The problem is considered to be severe on the more excessively drained areas. Rather thorough site preparation and eliminating most of the competing vegetation, is needed to provide adequate restocking.

Equipment limitations are only slight on the moderately shallow phases of Lakeland and Ruston loamy fine sands. They are moderate on Lakeland fine sand, very deep phase, due to the poor traction provided by the loose sands during dry weather. Care should be exercised in location and maintenance of roads on these soils, and the maintenance of adequate roads is apt to be expensive. Less difficulty is encountered in logging these soils while they are moist than when they are dry.

Erosion hazard is moderate where slopes exceed about 5 percent, due to the tendency of the sandy soils to develop gullies where water is concentrated. Location, construction and maintenance of roads, skid trails and fire lanes should be done carefully to minimize this hazard.

Windthrow hazard is no particular problem on the very deep phase of Lakeland fine sand. There is a moderate problem of windthrow on the moderately shallow phases of the Lakeland and Ruston loamy fine sands due to limited root depth on these soils. This hazard should be taken into consideration in planning density control (a greater than normal stand density to be maintained) in intermediate and harvest cuttings.

Soil related woodland pest hazard is severe. The Texas leaf-cutting ant (Bennett, 1961) and pocket gophers are apt to cause severe damage to trees during the first few years after planting. Pest control prior to planting is advisable where those pests are present. Gophers are usually prevalent on or near old fields.

Woodland Suitability Group 11 - FC

The soils of this group are mostly fine and very fine sandy loams. They are very slowly permeable, except the Cuthbert soils, which are slowly permeable and are thinly developed and droughty. These soils are moderately well drained to excessively drained. A few have significant amounts of iron ore and fragmentary gravel, especially in the surface layers. A few of the soils are stony. They occupy erosional upland that is gently undulating to hilly, although the major areas are rolling. Slopes range from about 1 to 20 percent, but dominantly are about 3 to 15 percent. Surfaces are mostly convex and plane.

The soils of this group are essentially the same as those of woodland suitability group 1-FC. This group is separated from group 1 on the basis of being in a different rainfall-evapo-transpiration zone. The

data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in Figures 1 and 3.

The soils in this group are:

Boswell fine sandy loam
Boswell very fine sandy loam
Boswell gravelly fine sandy loam
Boswell gravelly very fine sandy loam
Boswell sandy clay loam, severely eroded
Boswell clay, severely eroded
Boswell stony fine sandy loam
Cuthbert fine sandy loam
Cuthbert gravelly fine sandy loam
Cuthbert gravelly sandy loam
Cuthbert stony fine sandy loam
Susquehanna fine sandy loam
Susquehanna very fine sandy loam
Susquehanna fine sandy loam, thick surface
Susquehanna sandy clay loam, severely eroded

Site index is 70 for loblolly and 65 for shortleaf pine. Longleaf pine is not adapted in the lower rainfall zone. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 300 board feet for loblolly and 280 board feet for shortleaf pine (Scribner, Fig. 8).

Loss of naturally occurring or planted seedlings during the first season varies from moderate on Susquehanna fine sandy loam, thick surface and Cuthbert fine sandy loam, to slight on the other soils in the group. The moderate problem is due to thickness of sandy surface soil, which has low moisture holding capacity and may cause seedlings to wilt permanently before their roots grow into the higher moisture-supplying clay layer in the profile. Ordinarily such losses are 25 to 50 percent, but may exceed 50 percent during an unusually droughty season and, in such cases, replanting is needed to obtain adequate stocking. Under normal conditions in managed stands, the other soils in this group will become adequately stocked by natural reseeding.

This group of soils generally is favorable to plant growth. For that reason plant competition is moderate between the desired pine species and undesirable plants when the canopy is opened or removed. Establishment occurs, but initial growth rate may be retarded to the extent that development of a fully stocked stand is delayed. Some site preparation such as girdling, use of chemicals, or burning of undesirable plants may be advisable to prevent delay in establishment of an adequate stand.

The equipment limitations of soils in this group range from slight to moderate. Because of very slowly permeable, plastic clay subsoils usually at shallow depths in the profile in the Boswell and Susquehanna

soils, there are periods during high rainfall seasons of late winter and early spring when the operation of equipment is limited. If equipment is used during this period, usually of less than three months, much damage to tree roots occurs, and operation of equipment is difficult. The Cuthbert soils occupy more rolling relief, have less clay in the subsoil, and cause no special problems in equipment operations due to wetness during any time of the year. The more steeply sloping areas of soils of this group have moderate equipment limitations, and careful planning of construction and maintenance of roads and skid trails is advisable.

The erosion hazard on the soils in this group is moderate on slopes of less than 8 percent and severe on slopes greater than 8 percent. This is due to very slow to slow internal drainage, which causes rapid runoff from steeper slopes. Roads and skid trails should be located along ridge tops or approximately on the contour to prevent the accumulation of water that causes gullies. Where this cannot be done, the installation of such water-control measures such as water bars, should be considered to prevent soil damage. Careful preservation of vegetative litter by protection from loss by wild fires, particularly on the more sloping areas, is another conservation measure that is advisable.

Woodland Suitability Group 12 - FC

This group consists of moderately shallow phases of slowly and very slowly permeable soils, which have restrictive layers of shale, sandstone, iron pan or other impermeable material, usually beginning at depths of 20 to 40 inches, but which may begin within 50 inches below the surface. Also included in this group are some steeply sloping, gravelly and stony soils on which rainfall is less effective than on the other phases of the soil series. The soil characteristics described above restrict root penetration and available moisture storage, which cause trees to be affected by drought. Slopes range from about 1 to 40 percent, but dominantly are about 3 to 20 percent. Some Bub and Cuthbert soils have slopes of over 20 percent.

The soils of this group are essentially the same as those of woodland suitability group 2-FC. This group is separated from group 2 on the basis of being in a different rainfall-evapo-transpiration zone. The data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in figures 1 and 3.

The soils in this group are:

Boswell fine sandy loam, moderately shallow
Boswell gravelly fine sandy loam, moderately shallow
Boswell gravelly very fine sandy loam, moderately shallow
Bub gravelly fine sandy loam
Bub gravelly loam
Bub stony loam

Caddo fine sandy loam, moderately shallow
Conroe gravelly fine sandy loam
Conroe gravelly loamy fine sand
Cuthbert fine sandy loam, moderately shallow
Cuthbert gravelly sandy loam, moderately shallow
Cuthbert stony fine sandy loam
Kirvin fine sandy loam, moderately shallow
Kirvin gravelly fine sandy loam, moderately shallow
Nacogdoches clay loam
Nacogdoches gravelly clay loam
Nacogdoches gravelly fine sandy loam

The site index is 65 for shortleaf pine. Neither loblolly nor longleaf are adapted. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 280 board feet (Scribner, Fig. 8) for shortleaf pine.

The mortality of both planted and naturally occurring seedlings is considered to be moderate for the soils of this group due to the limited available moisture and to the difficulty of doing a good job of planting on the more gravelly and stony soils. The problem approaches severe on the more shallow gravelly ridges. Losses between 25 and 50 percent of seedlings can be expected from soil influences. Some replanting to fill in openings usually is needed, and natural regeneration cannot always be relied on for adequate restocking.

Plant competition of undesirable species is considered to be moderate on these soils when openings are made in the canopy. Establishment of desired species may be delayed, thereby delaying the development of a fully stocked stand, unless management practices such as girdling, chemicals or prescription burning, are used to control the competing vegetation.

Equipment limitation due to wetness is no particular problem on these droughty, moderately shallow, and mostly gravelly soils. There is a moderate equipment limitation on the steeply sloping, and on the stony soils of the group. Type of tree planting equipment used, and location and maintenance of roads, skid trails and landings, are affected by these conditions.

The erosion hazard of the soils of this group, when managed according to acceptable standards, varies from moderate on the more gently sloping and more gravelly soils to severe on the less gravelly, steeply sloping soils. Careful planning of location, construction and maintenance of roads, trails and landings, as well as management of forest litter, are needed to control erosion on the steeper slopes.

The soils of this group are considered to have a moderate windthrow hazard. This is a result of shallow root system, which is caused by restrictive layers in the soils. Some windthrow can be expected during periods of great wind velocity or when ice-glaze is on the trees while the soils are saturated, particularly on exposed ridge tops and in thin stands (Fig. 10).

The pest hazard is considered to be moderate on the soils of this group. Limited available moisture supplied by the soils causes the trees to be weakened during extended periods of drought, and thus they are more susceptible to Ips beetle damage. Shortleaf pine, which is quite susceptible to tip moth damage, is the dominant pine species on most of these soils.

Woodland Suitability Group 13 - FC

The soils of this group are mostly fine and very fine sandy loams. They are slowly permeable, except the Bowie, Ruston and Magnolia soils, which differ in being moderately permeable. All of the soils store rather high amounts of available moisture, which makes them productive for pine timber. Slopes range from 0 to about 12 percent, and dominantly are less than 8 percent. The soils are well drained to moderately well drained.

The soils of this group are essentially the same as those of woodland suitability group 3-FC. This group is separated from group 3 on the basis of being in a different rainfall-evapo-transpiration zone. The data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in figures 1 and 3.

The soils in this group are:

Alto fine sandy loam
Bowie fine sandy loam
Bowie very fine sandy loam
Kirvin fine sandy loam
Kirvin gravelly fine sandy loam
Kirvin very fine sandy loam
Magnolia fine sandy loam
Muskogee very fine sandy loam
Muskogee very fine sandy loam, thick surface phase
Nacogdoches fine sandy loam
Ruston fine sandy loam
Sawyer fine sandy loam
Sawyer fine sandy loam, thick surface phase
Sawyer very fine sandy loam

Site index is 80 for loblolly and 70 for shortleaf pine. Longleaf pine is not adapted in the lower rainfall zone. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 425 board feet for lobolly and 360 board feet for shortleaf pine (Scribner, Fig. 8).

There is no special problem of mortality of either planted or naturally occurring seedlings on any of the soils of this group (Fig. 14) except two. The thick surfaced phases of Muskogee very fine sandy loam and Sawyer fine sandy loam can be expected to have moderate seedling mortality. This is due to the low moisture holding capacity of their thick surface soils, which may cause loss of seedlings during periods of

drought. Normally, losses of 25 to 50 percent of seedlings can be expected and some replanting to fill in openings will be needed on the thick surfaced soils.

Figure 14. Heavy stand of natural pine regeneration on Sawyer fine sandy loam.

Since these soils usually supply rather large amounts of available moisture, many competing plants grow on them, and plant competition for the desired species is considered moderate. Plant competition ordinarily will not prevent adequate stand establishment, but may retard initial growth and delay the development of a fully stocked stand, unless management practices, such as girdling, chemicals, or prescription burning are used to control the competing vegetation.

The equipment limitations are slight on the well drained Kirvin, Magnolia, Nacogdoches, Ruston and most areas of the Bowie soils. The problem is moderate on the more nearly level, moderately well drained Alto, Muskogee, Sawyer, and the more moist areas of the Bowie soils. Some difficulty in logging and damage to tree roots from equipment can be expected on the latter soils during a period of less than about three months during winter and spring.

When managed according to currently acceptable standards, the more gently sloping areas of these soils have only a slight erosion hazard. The more rolling areas have a moderate erosion hazard and require erosion prevention measures, particularly good planning in location and maintenance of roads, trails and landings. Roads and trails should be built along ridgetops and on the contour to prevent water concentration.

Soil associated woodland pests pose a slight to moderate problem on these soils. Gophers may, unless controlled, do moderate damage to seedlings the first few years on the thicker surfaced, more permeable soils, particularly in and near old fields. They are usually no particular problem on the slowly permeable soils with normal surface layer thickness. Leaf-cutting ants (Bennett, 1961) may cause moderate damage on the thicker surfaced, more permeable, better drained soils, particularly when the soils are adjoining areas of coarse textured soils.

Woodland Suitability Group 14 - FC

The soils of this group are fine sandy loams to clay loams in texture, and they are permeable, well drained to poorly drained bottom land soils. Practically all areas are at least occasionally flooded, and most soil areas are subject to frequent flooding. All have seasonal water tables. In the Bibb soils the water tables are at or near the surface during the cool, moist season and usually are about 4 to 10 feet below the surface during the late part of the summer. Water tables in the other soils vary from about 2 to 4 feet below the surface in the cool, moist season to about 6 to 15 feet below the surface in the drier months. These soils are quite productive for pine timber if stands are obtained, because the available soil moisture is adequate.

The soils of this group are essentially the same as those of woodland suitability group 4-FC. This group is separated from group 4 on the basis of being in a different rainfall-evapo-transpiration zone. The data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in figures 1 and 3.

The soils in this group are:

Bibb clay loam
Bibb fine sandy loam
Bibb very fine sandy loam
Bibb silty clay loam

Hannahatchee clay loam
Hannahatchee fine sandy loam
Iuka clay loam
Iuka clay loam, clay substratum variant
Iuka clay loam, imperfectly drained
Iuka fine sandy loam
Iuka fine sandy loam, clay substratum variant
Iuka very fine sandy loam
Iuka very fine sandy loam, clay substratum variant
Ochlockonee clay loam
Ochlockonee fine sandy loam

Site index is 100 for loblolly and 90 for shortleaf pine. Longleaf pine is not adapted in the low rainfall zone. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 700 board feet for loblolly and 650 board feet for shortleaf pine (Scribner, Fig. 8).

Seedling mortality ranges from slight to severe on these soils and is due largely to overflows. The greater the frequency, duration and depth of overflow the more severe is the problem. Failure of seed to germinate and mortality of seedlings is particularly severe on the poorly drained Bibb soils where water stands for long periods during the rainy season. Natural regeneration usually is not reliable on the Bibb soils or on Iuka and Hannahatchee soils in flood plains of low gradient where overflow water remains for long periods. Water control may be necessary in some cases before stands can be established, even by planting. Seedling mortality is only slight on Ochlockonee soils.

Plant competition for the desired species is severe when openings are made in the canopy, because the high moisture supplying ability of these soils causes seedlings of competing hardwoods to thrive. Some tree planting may be necessary. Site preparation treatment such as the use of chemicals, girdling, or prescription burning of undesirable plants usually is necessary.

Equipment limitations are severe on these bottom land soils, because of high water tables and the soils being saturated for more than about three months of the year. The problem is particularly great on the poorly drained Bibb and clay substratum phases of Iuka soils, which may occur in association with the better drained Ochlockonee, Iuka or Hannahatchee soils, and in such areas the poorly drained soils must be crossed in logging operations. Use of equipment during the cool, moist season is difficult, and may cause serious damage to tree roots and soil structure.

Some windthrow may occur during glaze (ice) storms, when the trees are heavier than normal with ice coatings.

Woodland Suitability Group 15 - FC

The soils of this group have loamy fine sands and thicker than normal fine sandy loam surface layers. They are moderately to slowly permeable and well drained to moderately well drained. Some occupy nearly level, stream terrace positions and all of the soils have plentiful available moisture. Ochlockonee is a bottom land soil. Slopes are about 1 to 12 percent on the Bowie and Ruston loamy fine sands.

The soils of this group are essentially the same as those of woodland suitability group 7-FC. This group is separated from group 7 on the basis of being in a different rainfall-evapo-transpiration zone. The data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in figures 1 and 3.

The soils in the group are:

Bowie fine sandy loam, terrace phase
Bowie fine sandy loam, thick surface phase
Bowie loamy fine sand, thick surface phase
Bowie very fine sandy loam, thick surface phase
Klej fine sand
Klej loamy fine sand
Magnolia fine sandy loam, terrace phase
Ochlockonee loamy fine sand
Ruston fine sandy loam, terrace phase
Ruston fine sandy loam, thick surface phase
Ruston loamy fine sand
Ruston loamy fine sand, terrace phase
Sawyer fine sandy loam, terrace phase
Sawyer loamy fine sand

Site index is 80 for lobolly and 75 for shortleaf pine. Longleaf pine is not adapted in the low rainfall zone. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 425 board feet for loblolly and 435 board feet for shortleaf pine (Scribner, Fig. 8).

Seedling mortality is slight on the thinner surfaced terraced phases of Bowie, Sawyer, Magnolia and Ruston fine sandy loams. Adequate natural regeneration and satisfactory restocking with initial planting can be expected on these soils, since seedling mortality usually is less than 25 percent.

The thick surface phase soils, and the loamy fine sands of the group have a moderate seedling mortality problem due to their low moisture holding capacity. Losses of about 25 to 50 percent of seedlings can be expected on these soils. Some replanting to fill in openings may be needed.

The problem of plant competition is moderate on most soils of this group and is severe on some of the more moist soils, such as the terrace phase soils and the Klej soils, which occur in both stream terrace positions and in interstream divides. Since these soils supply rather large amounts of available moisture, considerable competing vegetation is usually present when openings are made in the canopy. This may delay development of a fully stocked stand unless competing vegetation is controlled by practices such as girdling, use of chemicals or prescription burning.

Equipment limitations are moderate on the more level and moist areas of the moderately well drained Bowie, Sawyer, Ochlockonee, and Klej soils. Logging operations will usually be restricted for periods up to three months during the rainy season, because the soils usually are near saturation and there is a danger of root and soil damage by equipment.

The erosion hazard is slight where slopes are less than about 5 percent. There is a moderate erosion hazard on the more sloping to hilly areas of Bowie and Ruston loamy fine sands. The thick surface phases and loamy fine sands are particularly susceptible to gullying where water is concentrated. Care should be exercised to lay out roads and trails on ridge tops where practical, provide water bars and turnouts where needed, and maintain roads to control erosion.

The soil associated woodland pest problem is only slight on the fine sandy loams and the Ochlockonee loamy fine sands, particularly in virgin areas not associated with old fields. Gophers and leaf-cutting ants (Bennett, 1961) pose a moderate problem on the thick surfaced phases and the loamy fine sands of the group. The gophers usually are more prevalent on and adjacent to old fields. Some replanting and pest control will probably be needed to obtain a fully stocked stand on the latter soils.

Woodland Suitability Group 16 - FC

These are loamy fine sands and fine sands that have rapidly to slowly permeable subsoils. Slopes range from 0 to about 20 percent, and dominantly are about 2 to 15 percent.

The soils of this group are essentially the same as those of woodland suitability group 8-FC. This group is separated from group 8 on the basis of being in a different rainfall-evapo-transpiration zone. The data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in figures 1 and 3.

The soils in the group are:

Boswell loamy fine sand
Cuthbert loamy fine sand
Eustis fine sand
Eustis loamy fine sand
Eustis loamy fine sand, terrace phase

Kirvin loamy fine sand
Lakeland fine sand
Lakeland loamy fine sand
Susquehanna loamy fine sand

These soils are droughty for shallow rooted plants and young pine seedlings due to the thick sandy surface soils, but they have higher moisture supplying sandy clay loam to clay subsoils within the reach of pine tree roots. Depth to clayey subsoils of the Boswell, Cuthbert, Kirvin, and Susquehanna loamy fine sands is within 36 inches of the surface. In the other soils of the group the less sandy subsoil or substratum is encountered within 72 inches. These soils have rapid intake rates and a large percent of the water in the soil is available to plants.

Site index is 70 for loblolly and 65 for shortleaf pine. Longleaf pine is not adapted in the low rainfall zone. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 300 board feet for loblolly and 280 board feet for shortleaf pine (Scribner, Fig. 8).

Seedling mortality is moderate on the Boswell, Cuthbert, Kirvin and Susquehanna loamy fine sand and Eustis loamy fine sand, terrace phase. A loss of 25 to 50 percent of seedlings can be expected on these soils, and some replanting will usually be needed. Natural regeneration cannot always be relied on for restocking. Seedling mortality is severe on the other soils of the group. Losses of planted stock usually are over 50 percent on the Lakeland and Eustis soils. Seedbed preparation, use of good quality, well developed seedlings, considerable replanting, and superior planting techniques are necessary to secure adequate restocking on the deeper sandy soils.

Plant competition usually is only slight on the Boswell, Cuthbert, Eustis, Kirvin and Lakeland soils. On the Eustis loamy fine sand, terrace phase, and the Susquehanna soils, competing vegetation is a moderate problem, because they are high moisture supplying soils. Initial growth of pine seedlings may be slowed and development of an adequate stand may be delayed, unless management techniques such as girdling, chemicals or prescription burning are used to control the competing plants.

Equipment limitations are slight on the undulating to sloping areas of the Boswell, Cuthbert, Kirvin and Susquehanna loamy fine sands. The problem is moderate on the rolling to steep areas of these soils, and on all areas of the other soils of the group. This problem is due to the poor traction provided by these loose, structureless coarse textured soils during dry weather and to some lack of stability on the more moist areas of the Susquehanna loamy fine sands during rainy seasons. Care must be exercised in location and maintenance of roads, and in following the contour with mechanical planting equipment where this problem exists.

The erosion hazard is slight or moderate on the less sloping areas, and severe on the rolling to hilly areas, due largely to the tendency of these soils to develop gullies where water is concentrated. Care should be exercised to lay out roads or trails on ridge tops where possible, and to provide water bars and turnouts where needed. Careful maintenance of roads should be provided.

The soil associated woodland pests, leaf-cutting ants (Bennett, 1961), and particularly gophers, are apt to cause severe damage on the deep sands (Lakeland and Eustis). These pests are apt to cause moderate damage on the Boswell, Cuthbert, Kirvin, and Susquehanna soils, particularly on or adjacent to old fields. Eradication of pests before planting is advisable.

Woodland Suitability Group 17 - FC

The soils of this group are imperfectly and poorly drained, very fine sandy loams to loamy fine sands which have moderately to very slowly permeable subsoils or substrata.

The soils of this group are essentially the same as those of woodland suitability group 9-FC. This group is separated from group 9 on the basis of being in a different rainfall-evapo-transpiration zone. The data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in figures 1 and 3.

The soils in the group are:

Byars very fine sandy loam, thick surface phase
Caddo fine sandy loam
Caddo fine sandy loam, clayey substratum variant
Caddo fine sandy loam, thick surface phase
Caddo loamy fine sand
Caddo loamy fine sand, clayey substratum variant
Caddo very fine sandy loam
Caddo very fine sandy loam, thick surface phase
Caddo very fine sandy loam, clayey substratum variant
Plummer loamy fine sand
Plummer loamy fine sand, clay substratum variant
Rains-like fine sandy loam
Rains-like fine sandy loam, clay substratum variant

The Byars very fine sandy loam, thick surface phase, Rains-like soils, and the Plummer soils are poorly drained. Caddo soils are imperfectly drained. The two Rains-like fine sandy loams, and Plummer loamy fine sand, clay substratum variant, are field names for two uncorrelated soils developed in the Catahoula and similar geologic formations. All of the soils of this group supply large amounts of available moisture and are quite productive for pine timber.

Site index is 80 for loblolly and 75 for shortleaf pine. Longleaf pine is not adapted in the low rainfall zone. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 425 board feet for loblolly and 435 board feet for shortleaf pine (Scribner, Fig. 8).

Seedling mortality is considered to be moderate due to the low moisture holding capacity of the thick surface layers of Caddo and Plummer loamy fine sands, and because of the poor drainage in all but the Caddo soils. The problem may be severe on very poorly drained or ponded phases of Byars and Rains-like soils. A loss of 25 to 50 percent of seedlings can be expected where the problem is moderate and some replanting usually will be needed. Natural regeneration cannot always be relied on for restocking. Seedling mortality is slight on Caddo fine sandy loam with usual losses of less than 25 percent.

The degree of plant competition on these high moisture supplying soils is severe where seed sources of competing vegetation are present. Natural regeneration cannot be relied on to provide adequate restocking of pine species. Special site preparation treatment such as girdling, use of chemicals or prescription burning usually is necessary. Replanting may be needed.

Equipment limitations are severe on these soils. Difficulty in logging and damage to tree roots and the soil can be expected for a period of about three months during the cool, moist season.

Woodland Suitability Group 18 - FC

These are very droughty fine sands and loamy fine sands which are very limited in their storage of available moisture. Most of the soils have excessive internal drainage. Slopes range from 0 to about 20 percent.

The soils of this group are essentially the same as those of woodland suitability group 10-FC. This group is separated from group 10 on the basis of being in a different rainfall-evapo-transpiration zone. The data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in figures 1 and 3.

The soils in the group are:

Lakeland fine sand, very deep phase
Lakeland loamy fine sand, moderately shallow phase
Ruston loamy fine sand, moderately shallow phase

The very deep phases of Lakeland fine sand is deeper than 72 inches to less sandy material and the soil has limited moisture supply, especially during dry periods. The moderately shallow phases of Lakeland and Ruston loamy fine sands are underlain by sandstone or a moderately to strongly cemented layer beginning at depths of 20 to 50 inches, but usually begin-

ning between 30 to 40 inches below the surface. Such layers severely restrict moisture and tree root penetration. The drought resistant shortleaf and longleaf species are much more prevalent on these soils than loblolly pine. A scrubby and often sparse growth of sandjack and blackjack oak are the dominant associated species on these droughty sands.

Site index is 55 for both loblolly and shortleaf pines. Longleaf pine is not adapted in the low rainfall zone. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 145 board feet (Scribner, Fig. 8) of shortleaf pine. Production for loblolly is estimated to be slightly lower.

Seedling mortality generally is severe, because the soils do not hold enough moisture during the dry season of the year. Expected losses due to soil influences ordinarily are over 50 percent and may approach 100 percent on the more excessively drained, very deep phase of Lakeland. Natural regeneration cannot be relied on. Planting, preferably during a cycle of higher rainfall, with considerable replanting, special seedbed preparation, superior planting techniques and use of best quality seedlings, is needed to assure adequate restocking.

The degree of plant competition following removal of overstory is considered moderate to severe. The amount of competing vegetation is small compared with that of more moist sites, but the amount of moisture available for seedlings is so low during dry periods that even this amount of competition is considered a moderate problem. Some seedbed preparation usually is needed to provide restocking of recommended planted seedlings. The problem is considered to be severe on the more excessively drained areas. Rather thorough site preparation and eliminating most of the competing vegetation is needed to provide adequate restocking.

Equipment limitations are only slight on the moderately shallow phases of Lakeland and Ruston loamy fine sands. They are moderate on Lakeland fine sand, very deep phase, due to the poor traction provided by the loose sands during dry weather. Care should be exercised in location and maintenance of roads on these soils, and the maintenance of adequate roads is apt to be expensive. Less difficulty is encountered in logging these soils while they are moist than when they are dry.

Erosion hazard is moderate where slopes exceed about 5 percent, due to the tendency of the sandy soils to develop gullies where water is concentrated. Location, construction and maintenance of roads, skid trails and fire lanes should be done carefully to minimize this hazard.

Windthrow hazard is no particular problem on the very deep phase of Lakeland fine sand. There is a moderate problem of windthrow on the moderately shallow phases of the Lakeland and Ruston loamy fine sands due to limited root depth on these soils. This hazard should be taken into consideration in planning density control (a greater than normal stand density to be maintained) in intermediate and harvest cuttings.

Soil related woodland pest hazard is severe. The Texas leaf-cutting ant (Bennett, 1961) and pocket gophers are apt to cause severe damage to trees during the first few years after planting. Pest control prior to planting is advisable where those pests are present. Gophers are usually more prevalent on or near old fields.

Woodland Suitability Group 19 - FC

This group consists of poorly to imperfectly drained soils that are sandy loam to clay in texture. They have slowly and very slowly permeable clayey subsoils. The soils occupy upland "flats". They generally are saturated with water during the cool, moist season, but tend to be very dry during the late summer and early fall. Their subsoils are structureless to weak blocky and they have low porosity.

The soils of this group are essentially the same as those of woodland suitability group 6-FC. This group is separated from group 6 on the basis of being in a different rainfall-evapo-transpiration zone. The data given for this group is applicable to soils in the less than 44-inch average annual rainfall zone of the oak-pine and loblolly-shortleaf pine forest type areas of east Texas, as illustrated in figures 1 and 3.

The soils in the group are:

Byars clay loam
Byars fine sandy loam
Byars very fine sandy loam
Garner clay
Rains very fine sandy loam
Wrightsville silt loam
Wrightsville very fine sandy loam

The soils have very slowly to slowly permeable clayey subsoils that have low capillary pore space, which causes the soils in more level to depressed areas to be wet natured in the cool rainy season and all areas to be rather droughty in dry seasons.

Site index is 75 for loblolly and 70 for shortleaf pine. Longleaf pine is not adapted to this group of soils in the lower rainfall zone. For overstocked, unmanaged stands of age 50 years, the soils are expected to produce an average annual growth per acre of about 360 board feet for both loblolly and shortleaf pine (Scribner, Fig. 8).

Mortality of naturally occurring seedlings is severe because of poor soil drainage. Natural regeneration cannot be relied on unless surface drainage is provided. Mortality of planted seedlings is moderate, and some replanting usually is necessary to fill in the openings where seedlings fail to survive.

Moderate plant competition, especially from hardwood trees, can be expected to interfere with establishment and growth of pine. Some management practices such as girdling, use of chemicals, or prescription burning may be needed to control the competing vegetation in areas of abundant seed source.

Equipment limitations are severe. Logging may be difficult and result in damage to roots and soil for a period of about three months during the cool, moist season.

Windthrow is a moderate problem, because of shallow rooting of trees in the poorly drained soils. Careful density control in intermediate and harvest-cutting operations is needed to minimize this hazard.

Table 7 WOODLAND SUITABILITY GROUPINGS OF SOILS FOR THE FLATWOODS PORTION (FCC) OF THE EAST TEXAS TIMBERLAND RESOURCE AREA

Group No.	Generalized Description of Soils[1]	Average Site Index			Seedling Mortality	Plant Competition	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Pest Hazard	Suitable Species
		Lob.[2]	Short.	Long.							
1 - FCC	Mostly imperfectly drained, moderately to very slowly permeable, moderately coarse to medium textured soils; typified by the Caddo series.	95	85[3] *	85 *	Slight	Severe	Severe	None to Slight	Slight	Slight	Loblolly, Slash, Shortleaf, and Longleaf pines; Southern hardwoods.
2 - FCC	Mostly medium textured, slowly to very slowly permeable, poorly drained soils. Typified by the Byars Series.	90	80 *	80 *	Severe	Severe	Severe	None to Slight	Mod.	Slight	Loblolly, Slash, Shortleaf, and Longleaf pines; Southern hardwoods.
3 - FCC	Poorly drained, mostly fine and medium textured, very slowly to slowly permeable soils; flat to depressed relief; typified by Garner clay.	85	-[4]	75 *	Moderate to Severe	Severe	Severe	None to Slight	Slight to Mod.	Slight	Loblolly, Slash, and Longleaf pines; Southern hardwoods.
4 - FCC	Moderately coarse to fine textured, moderately well drained bottom land soils; moderately permeable; typified by Iuka series.	105 *	95 *	-	Slight	Severe	Severe	None to Slight	Slight	Slight	Loblolly, Slash, and Shortleaf pines; Southern hardwoods.
5 - FCC	Moderately coarse to medium textured, moderately well drained, mostly slowly permeable soils; typified by the Sawyer series.	90	80 *	80 *	Slight	Mod. to Severe	Slight to Mod.	Slight to Mod.	Slight	Slight	Loblolly, Slash, Shortleaf, and Longleaf pines; Mixed upland oaks.
6 - FCC	Moderately coarse to medium textured, moderately well drained, mostly moderately permeable soils; typified by the Bowie series.	85	75	75	Slight to Moderate	Mod.	Slight to Mod.	Slight to Mod.	Slight	Slight to Mod.	Loblolly, Slash, Shortleaf, and Longleaf pines; Mixed upland oaks.

1/ The narrative for each group lists all of the soils that are included.

2/ Until information is available it is assumed that these values for loblolly pine represent a close approximation for slash pine.

3/ Values marked by an asterisk (*) have been assigned or adjusted (see text).

4/ Where a dash (-) is shown, no data is available. The species concerned is not prevalent on these soils.

Table 7 WOODLAND SUITABILITY GROUPINGS OF SOILS FOR THE FLATWOODS PORTION (FCC) OF THE EAST TEXAS TIMBERLAND RESOURCE AREA

Group No.	Generalized Description of Soils[1/]	Average Site Index			Seedling Mortality	Plant Competition	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Pest Hazard	Suitable Species
		Lob.[2/]	Short.	Long.							
7 - FCC	Coarse and moderately coarse, imperfectly to moderately well drained soils; mostly rapidly permeable and with water tables furnishing adequate moisture throughout the year; typified by the Klej series.	95	85 *	85 *	Moderate to Slight	Mod. to Severe	Slight to Mod.	None to Slight	Slight	Mod.	Loblolly, Slash, Shortleaf, and Longleaf pines; Southern hardwoods.
8 - FCC	Deep beds of sands; typified by Lakeland fine sand, very deep phase.	70 *	65	65 *	Severe	Mod.	Slight to Mod.	None to Slight	Slight	Mod.	Longleaf, Loblolly, Shortleaf pines; Southern hardwoods
9 - FCC	Poorly drained and frequently flooded, usually with high water tables near the surface during the cool, moist season; typified by the Bibb series.	100 *	-	-	Severe	Severe	Severe	None to Slight	Slight to Mod.	Slight	Southern hardwoods; Loblolly pine.

Woodland Suitability Group 1 - FCC

The soils of this group are moderately to very slowly permeable, mostly imperfectly drained, and are mostly of fine and very fine sandy loam texture. Some of them are thick surface phases. Caddo loamy fine sand has a coarse textured surface layer. Caddo loamy fine sand occurs in complex areas with Bowie loamy fine sand. The latter soil is in woodland suitability group 6-FCC. The imperfectly drained Caddo soils occur in lower swale positions, and the moderately well drained Bowie soils occur in the slight ridges. The soils of this group occupy a nearly level to gently undulating, only slightly dissected coastal terrace. They supply large amounts of available moisture for timber production, as well as for competing vegetation. The favorable amount of available moisture is due mainly to high rainfall, seasonal water tables, and slow surface runoff.

The soils in the group are:

Acadia fine sandy loam
Acadia very fine sandy loam
Acadia very fine sandy loam, thick surface
Caddo fine sandy loam
Caddo fine sandy loam, thick surface phase
Caddo fine sandy loam, clayey subsoil variant
Caddo fine sandy loam, clayey substratum variant
Caddo very fine sandy loam
Caddo very fine sandy loam, clayey subsoil variant
Caddo loamy fine sand

Site index is 95 for loblolly, 85 for shortleaf, and 85 for longleaf pine. In overstocked, unmanaged stands of age 50 years, the soils can be expected to produce an average annual growth per acre of about 625 board feet for loblolly, 575 board feet of shortleaf or 415 board feet of longleaf pine (Scribner, Fig. 8). Some desirable hardwood species are found on these soils and may need to be given consideration in management.

A few plots of these soils, particularly the thick surface phases of Acadia and Caddo, occurring adjacent to poorly drained flats of Rains soils or as foot slopes were found to have a site index of approximately 100 for loblolly pine. Apparently the sites were supplied extra moisture by sub-irrigation or seepage. Further study is needed to determine if such sites occur in sufficient size and amount to warrant mapping position phases or soil associations to designate those superior sites.

Seedling mortality is no particular problem, because the soils supply adequate moisture. Normally, satisfactory restocking can be expected from initial planting and regeneration usually is adequate.

Many competing plants grow on these soils, because of high available moisture. Severe competition for pine seedlings can be expected when openings are made in the canopy. On some areas of native longleaf pine

hardwoods have been controlled by wildfires. Special site preparation treatments, such as prescription burning, use of chemicals or girdling with occasional areas of tree planting, usually result in adequate restocking with pine species.

Equipment limitations are severe, because the soils are imperfectly drained and nearly level, and they may be saturated much of the cool rainy season. Logging usually is confined to the dry season. Considerable damage to tree roots and difficulty in operations can be expected if equipment is used during the 3 or 4-month cool moist season.

Woodland Suitability Group 2 - FCC

These are poorly drained soils of fine and very fine sandy loam textures, and which have subsoils that are slowly to very slowly permeable and of sandy clay loam to clay in texture.

The soils in the group are:

Byars fine sandy loam
Byars very fine sandy loam
Byars very fine sandy loam, thick surface phase
Rains very fine sandy loam

The soils occur both in mappable-sized areas of a single soil, and in soil complexes of two or more taxonomic units. A soil complex consists of two or more kinds of soils that occur in intricate pattern, but the individual soils cannot be separated by soil boundaries at the map scale ordinarily used.

The Byars and Rains soils occur in complex areas with either Caddo fine sandy loam, Klej loamy fine sand, Magnolia fine sandy loam, terrace phase, or Ruston very fine sandy loam, terrace phase. In the complexes, the poorly drained Byars and Rains occupy the swales or low sinuous or intermound areas, while the better drained Caddo, Klej, Magnolia, and Ruston soils occupy microridges and mounds. There is a high percentage of water-tolerant hardwoods in the stands of timber, especially in the poorly drained "flats" where the Byars and Rains soils occur. Some of the hardwoods produced on the soils of this group are the better species, such as white oak, water oak, willow oak, black gum and magnolia. In some soil areas where it is difficult to get pine established, production of hardwoods may be more practical.

Rains soils have slowly permeable subsoils and substrata that apparently allow excess water to move gradually through the soil. Thus, they are more favorable soils for pine growth than Byars soils, which have more clayey substrata that restrict internal drainage. When pine stands are obtained, the soils of this group are productive.

Site index is 90 for loblolly. Shortleaf pine usually does not grow on the soils, but a site index of 80 was assigned for shortleaf on the basis of measurements made on the same soils of the 44" and greater rainfall zone of the FC Land Resource Area. Longleaf pine stands originally were on the Rains soils, but stands adequate for sampling were not found. A site index of 80 was assigned, based on measurements made on trees growing on other soils, and by using a 10 foot lower site index for longleaf than for loblolly. In overstocked, unmanaged stands of age 50 years, the soils can be expected to produce an average annual growth of about 555 board feet of loblolly, 500 board feet of shortleaf or 350 board feet of longleaf pine (Scribner, Fig. 8).

Seedling mortality of pine is severe. Natural regeneration of pine species is unreliable on these poorly drained soils. Planting, special seedbed preparation, and water control (controlled surface drainage, Fig. 15) may be helpful in restocking.

Plant competition is severe. Many water-tolerant species, particularly water and willow oak, usually are present. Special management and site preparation treatments, such as prescription burning, use of chemicals, girdling, and planting usually are necessary to obtain adequate restocking with pine species.

Figure 15. Water control measures as a woodland management practice in Flatwoods portion of East Texas Timberlands.

4-17609 REV. 3-64

Equipment limitation is severe on these nearly level to depressional, poorly drained soils. Severe damage to tree roots and difficulty of operations will result, unless use of equipment is limited to seasons of low rainfall. Good quality, well drained and well maintained roads are needed.

Windthrow is a moderate problem, because the soils are saturated during the rainy season and the trees have shallow root systems. This should be taken into consideration in making recommendations for stand density control in intermediate and harvest cuttings.

Woodland Suitability Group 3 - FCC

The soils of this group are of very fine sandy loam, clay loam, or clay texture in their surface layers, and they have very slowly permeable subsoils or substrata. The poorly drained Byars and Rains soils occur in "flats" or depressional areas. Garner clay is imperfectly drained. These soils are droughty in dry periods, which occur some years, usually during late summer.

The soils in the group are:

Byars clay loam
Garner clay
Rains very fine sandy loam, clayey substratum variant

Byars and Rains soils occur either in mappable-sized areas of a single soil, or in complex areas with ridge and swale microrelief. Byars occurs in complex areas with Acadia fine sandy loam, and the Rains usually occurs in complex areas with Caddo very fine sandy loam, clayey substratum variant. The Byars and Rains soils occur in the depressional or swale positions while Acadia and Byars occupy microridge positions. Garner soils are in broad, flat to very gently sloping areas.

Usually there is a high percentage of water-tolerant hardwoods in the stand. Some desirable species of hardwoods grow on these soils, and in places production of hardwoods may need to be considered in management. For example, in complex areas hardwoods might be grown in the swales on Byars and Rains soils and pine might be managed on the microridges in which Caddo and Acadia soils occur.

There is a severe problem of seedling mortality and apparently retarded growth of young pine trees on Byars and Rains soils, because they are poorly drained, and may be saturated for enough time to"drown" the pine seedlings. Garner clay has moderate seedling mortality or losses of about 25 to 50 percent. Natural regeneration cannot always be relied on for restocking on any of the soils of this group. Planting and considerable replanting usually is needed. In some soil areas, controlled surface drainage, or special seedbed preparation may be needed.

When adequate stands are obtained the soils are moderately productive. Site index is 85 for loblolly and 75 for longleaf. Shortleaf pine is not adapted on this group of soils. In overstocked, unmanaged stands of age 50 years, the soils can be expected to produce an average annual growth per acre of about 490 board feet of loblolly, or 285 feet of longleaf (Scribner, Fig. 8).

Plant competition is severe on these high moisture supplying soils when openings are made in the canopy. Natural regeneration cannot be relied on. Special site preparation such as prescription burning, use of chemicals, girdling and possibly planting and replanting may be needed. There usually is a high percentage of water oak and willow oak in the overstory on these soils, particularly the poorly drained ones.

Equipment limitation is severe on these soils. Serious damage to tree roots and considerable difficulty in logging will result unless equipment use is restricted during the cool, rainy season, usually more than three months.

Windthrow is only a slight problem on the Garner clay. There is a moderate problem of windthrow on the Byars and Rains soils because they are saturated for extended periods. The trees growing in these poorly drained soils have shallow root development thus poor anchorage. This should be taken into consideration in making recommendations for stand density control in intermediate and harvest cuttings.

Woodland Suitability Group 4 - FCC

The soils of this group are fine sandy loam to clay loam textured, moderately to slowly permeable alluvial soils. They are imperfectly to well drained, but are subject to frequent overflows. They supply large amounts of available moisture and are high producing timber sites.

The soils in this group are:

Iuka clay loam
Iuka fine sandy loam
Iuka very fine sandy loam
Ochlockonee fine sandy loam

Site index is 105 for loblolly pine. Shortleaf and longleaf pine generally do not occur on these soils. However, a site index of 95 has been assigned for shortleaf pine, based on the soil characteristics that are favorable for pine growth. Some desirable species of hardwoods grow on these soils, and in places they may need to be given consideration in management. In overstocked, unmanaged stands of age 50 years, the soils of this group can be expected to produce an average annual growth per acre of about 775 board feet of loblolly or 725 board feet of shortleaf pine (Scribner, Fig. 8).

Seedling mortality usually is slight on these soils. Ordinarily, losses due to soil influences are less than 25 percent for planted stock. Natural regeneration usually is adequate, if competing vegetation is controlled.

Plant competition to young pine is severe when openings are made in the canopy, because the large amount of available moisture supports many competing plants, and seed sources of competing trees are usually abundant. Desired species usually must be released from competing vegetation. Special management and site preparation treatments, such as prescription burning, use of chemicals, girdling, and replanting usually are necessary to secure adequate restocking.

Equipment limitation is severe on these bottom land soils in this high rainfall area. Equipment should not be used for a period greater than about three months during the cool, moist season because of serious damage to tree roots and considerable difficulty in logging.

Woodland Suitability Group 5 - FCC

These are fine and very fine sandy loam textured, nearly level to gently sloping, moderately to slowly permeable soils. They are productive for pine, because of their high available moisture storage capacity and other favorable soil characteristics. They are mostly moderately well drained. The Ruston is well drained.

The soils in the group are:

Beauregard fine sandy loam
Ruston fine sandy loam
Sawyer fine sandy loam
Sawyer fine sandy loam, thick surface phase

Site index for loblolly pine is 90. Loblolly is the dominant pine species on these high moisture supplying soils. Stands of shortleaf and longleaf pine suitable for sampling were not found. Site indexes of 80 have been supplied for these species on the basis of measurements made on soils with some similar physical characteristics. In overstocked, unmanaged stands of age 50 years, the soils can be expected to produce an average annual growth per acre of about 555 board feet for loblolly, 500 board feet for shortleaf, and 350 board feet for longleaf pine (Scribner, Fig. 8).

Seedling mortality is slight for both planted and naturally occurring seedlings. Normally, one can expect satisfactory restocking from initial planting and adequate natural regeneration will usually take place.

Plant competition is moderate on the Ruston, Beauregard and better drained areas of the Sawyer soils. Development of a fully stocked stand may be delayed, but usually is not prevented by competition. Some simple site preparation may be needed in some areas. On moundy phases of Sawyer and the less well drained, nearly level areas of Sawyer fine sandy loam, the

plant competition problem is severe, because of adequate available moisture in the soils for competing plants. Special site preparation treatments, such as prescription burning, use of chemicals, girdling, and possibly planting, are necessary for adequate restocking of pine species.

Equipment limitations are no particular problem on Ruston fine sandy loam. There is a moderate problem on the Sawyer and Beauregard soils. On the latter two soils, considerable damage to tree roots and difficulty in logging will result, unless use of equipment is withheld for a period up to about 3 months during the cool moist season.

Erosion hazard is slight on the gently sloping areas of these soils, but it is moderate where slopes exceed about 5 percent. Attention should be given to the location and maintenance of roads and skid trails, and to the protection of litter from wildfire on these more sloping areas to control erosion.

Windthrow is only a slight problem on Ruston and Sawyer soils, but it is a moderate problem on Beauregard fine sandy loam. Density control should be recommended on the latter soil. Soil associated forest pests are usually no special problem on these soils. Some gopher damage may be expected on and near old fields, particularly on the Ruston soils, unless control measures are used.

Woodland Suitability Group 6 - FCC

The soils of this group are moderately deep to deep, fine sandy loam to loamy fine sand textured, and moderately to rapidly permeable. They are nearly level to gently sloping, have seasonal high water tables, and have weakly cemented substrata that apparently restrict depth of root penetration. In the portion of the area where longleaf pine was native, these soils originally supported a nearly pure stand of longleaf pine.

The soils in the group are:

Bowie fine sandy loam
Bowie fine sandy loam, thick surface phase
Bowie loamy fine sand
Bowie very fine sandy loam

Site index is 85 for loblolly, 75 for shortleaf, and 75 for longleaf pine. For overstocked, unmanaged stands of age 50 years, the soils should produce an average annual growth per acre of about 490 board feet for loblolly, 435 board feet for shortleaf, and 285 board feet for longleaf pine (Scribner, Fig. 8).

Seedling mortality is considered slight on the Bowie fine and very fine sandy loams. Adequate natural regeneration will usually take place and adequate restocking can usually be expected from initial planting. Seedling mortality is moderate on Bowie fine sandy loam, thick surface phases and the Bowie loamy fine sand, because of the low moisture-holding

capacity of the surface soils and the great depth to higher moisture-supplying soil layers. Losses between 25 and 50 percent of planted seedlings can be expected on these soils, and some replanting will be needed. Natural regeneration cannot always be relied on for restocking.

Plant competition is a moderate problem. Development of a fully stocked stand usually will not be prevented by competition, but is apt to be delayed unless some site preparation such as girdling, use of chemicals, or prescription burning is carried out.

Equipment limitation is considered slight on the loamy fine sand types and the better drained more convex slopes of the fine and very fine sandy loam soils. It is a moderate problem on the more level and less well drained areas of the Bowie fine and very fine sandy loam soils that do not have thick surface layers. Considerable damage to tree roots and difficulty in operations will result unless use of equipment is withheld for a period of less than three months during the rainy season on the latter soils of the group.

Erosion hazard is slight on gently sloping areas, but moderate on the more sloping areas of Bowie loamy fine sand. The latter soils are subject to gullying where water is concentrated. Care should be exercised in location, construction and maintenance of roads and skid trails to reduce this hazard.

Soil associated woodland pest hazard is only slight on the Bowie fine and very fine sandy loams. There is a moderate problem of gopher damage to young pine stands on the thick surface phase of Bowie loamy fine sand, particularly on or near old fields. Leaf-cutting ants may be a moderate problem on Bowie loamy fine sand. Control measures should be applied prior to planting where these pests are present.

Woodland Suitability Group 7 - FCC

This group consists of soils with surface layers having loamy fine sand, fine sand, or fine sandy loam texture and with rapidly to slowly permeable subsoils. They are moderately well drained to well drained. In places they occur in intricate complex soil areas with the Rains soils that are in woodland suitability group 2 - FCC. The Eustis and Klej soils have sandy layers about 36 to 60 inches thick. All of the soils are excellent for growing timber, because of the nearly level relief, their low position in relation to other soils and resulting water table that supplies adequate available moisture for trees.

The soils in the group are:

Bowie loamy fine sand, terrace phase
Eustis fine sand, terrace phase
Eustis loamy fine sand, terrace phase
Klej fine sand

Klej loamy fine sand
Ruston fine sandy loam, terrace phase
Sawyer fine sandy loam, terrace phase

Site index is 95 for loblolly, 85 for shortleaf and 85 for longleaf pine. For overstocked, unmanaged stands of age 50 years, the soils can be expected to produce an average annual growth per acre of about 625 board feet for loblolly, 575 board feet for shortleaf, and 415 board feet for longleaf pine (Scribner, Fig. 8).

The Eustis, Bowie, and Klej soils have a moderate seedling mortality problem due to the low available moisture in the surface soil during the dry part of the season, and the depth to subsoil or substratum that supplies more water. Loss of 25 to 50 percent of seedlings can be expected. Some replanting to fill in openings is usually needed. Seedling mortality is only slight on the other soils.

Plant competition is moderate on the Klej, Eustis, and Ruston soils, but usually will not prevent adequate stand establishment. However, development of a fully stocked stand may be delayed, unless some site preparation is carried out. The problem is severe on the less well drained site of Klej-Sawyer complex areas, in complex areas of the soils with Rains and on Klej and Bowie loamy fine sands. Special management and site preparation, such as girdling, use of chemicals, prescription burning, and possibly tree planting, to secure adequate restocking with pine species on the latter soils are needed.

Equipment limitation is only slight on the well drained, sandier members of the group, Eustis and Bowie soils. A moderate limitation exists on the other soils, and some damage to tree roots and difficulty in operation of equipment can be expected if equipment is used for a period up to about three months during the rainy season.

The soil-associated forest pest hazard is moderate. Gophers may cause considerable damage to young pines chiefly on or near old fields. Leaf-cutting ants may cause moderate damage on the better drained sandier soils. Control measures should be carried out prior to planting where pests are present.

Woodland Suitability Group 8 - FCC

These very deep, rapidly permeable fine sands are excessively drained and have low moisture holding capacity. These sandy soils usually are deeper than 72 inches over less sandy materials. Thus, they are quite droughty for young seedlings. They are low producing sites compared with other soils of this high rainfall area. The low moisture holding capacity of these fine sands is reflected by the presence of considerable sandjack and blackjack oaks in the stand.

Lakeland fine sand, very deep phase, is the only soil recognized in this group.

Site index of 70 was assigned for loblolly, 65 for shortleaf, and 65 for longleaf pine. Adequate samples were not found, and the site indexes were assigned on the basis of the sampling of the same soils in the 44-inch and greater rainfall zone of the FC land resource area. In overstocked, unmanaged stands of age 50 years, the soils can be expected to produce an average annual growth per acre of about 300 feet for loblolly, 280 board feet for shortleaf, and 170 board feet for longleaf pine (Scribner, Fig. 8).

Seedling mortality is severe on these very deep, droughty, fine sands. Losses of over 50 percent can be expected from planted stock. Natural regeneration usually cannot be relied on. Seedbed preparation, planting and considerable replanting, superior planting techniques, and good quality planting stock are usually required to secure adequate restocking.

The degree of plant competition is considered to be moderate. The amount of competing vegetation is not as great on this soil as on some higher moisture supplying soils rated as having moderate plant competition. However, the amount of moisture available for seedlings is so low during dry periods that even this amount of competition is considered a moderate problem. Establishment of a pine stand may be delayed, and the initial growth may be very slow unless some site preparation is carried out.

Equipment limitation is only slight on the nearly level areas, but it is a moderate problem on the slightly higher, gently sloping areas. The loose, single grained sands afford poor traction during dry weather. The problem is not great during the cool, moist season.

There is a moderate soil-associated woodland pest hazard. Gophers are apt to cause considerable damage, mainly on or near old fields. Leaf-cutting ants (Bennett, 1961) may be present and cause damage to pine seedlings on this well drained soil. Where these pests are present, control measures should be applied prior to planting.

Woodland Suitability Group 9 - FCC

These soils have surface layers of clay loam to loamy fine sand texture. They are moderately and slowly permeable bottom land soils. They are poorly drained, and subject to frequent damaging flooding. Exception is the Ochlockonee loamy fine sand, a well drained soil which occurs in complex areas with Bibb soils. The Bibb soils usually occur in the low part of the flood plain, or they may occupy most of the flood plain of streams of low gradient. Water usually stands on the surface or near the surface of these soils for considerable periods during the rainy season. Water tolerant hardwoods, especially water oak and willow oak, usually make up a large percentage of woodland stands. The soils are productive pine sites, if stands are obtained.

The soils in the group are:

Bibb clay loam
Bibb fine sandy loam
Bibb very fine sandy loam
Ochlockonee loamy fine sand

The site index for loblolly pine is 100 for well-stocked, unmanaged stands. Shortleaf and longleaf pine usually do not occur on these soils. Since these soils are productive for some of the merchantable hardwood species, it may be desirable to manage some soil areas for hardwoods, or a combination of loblolly pine and hardwoods. For overstocked, unmanaged stands of age 50 years, the soils can be expected to produce an average annual growth per acre of about 700 board feet of loblolly pine (Scribner, Fig. 8).

Seedling mortality of naturally occurring seedlings is severe, due to poor drainage and flooding. Natural regeneration usually cannot be relied on. Mortality of planted seedlings varies with the depth and duration of flooding. Where the problem is most severe, water control may be necessary before stands of pine can be established. Where the problem is most severe it may be more profitable to manage for hardwoods than for loblolly pine.

Plant competition is severe on these high moisture-supplying soils. Natural regeneration cannot be relied on to provide adequate restocking of pine species. Special management and site preparation treatments, such as girdling, prescription burning, use of chemicals, tree planting, and some replanting, are necessary to secure establishment of pine stands.

Equipment limitation is severe on these poorly drained soils. Considerable damage to tree roots and difficulty in operations will result unless use of equipment is withheld for a period, usually three to four months during the cool, moist season.

Windthrow hazard is slight on narrow flood plains of these soils, due to their low protected position. The windthrow problem is moderate in broader flood plains that are less protected from the wind than the narrow flood plains. Windthrow hazard is due to shallow root systems on the trees, and the extended period during which the soil is saturated and unstable.

Table 8 WOODLAND SUITABILITY GROUPINGS OF THE SOILS FOR THE COAST PRAIRIE (CO) LAND RESOURCE AREA

Group No.	Generalized Description of Soils[1]	Average Site Index			Seedling Mortality	Plant Competition	Equipment Limitation	Erosion Hazard	Windthrow Hazard	Pest Hazard	Suitable Species
		Lob.[2]	Short.	Long.							
1 - CO	Imperfectly to moderately well drained, mostly fine and medium textured soils with clayey subsoils; originally "grassland" soils on which timber has encroached; typified by Beaumont clay.	90	-[4]	85[3]*	Slight	Mod. to Severe	Severe	None to Slight	Slight	Slight	Loblolly, Slash, and Longleaf pine; Southern hardwoods.
2 - CO	Imperfectly drained, moderately coarse and medium textured, mostly very slowly to slowly permeable, but thick-surfaced soils; originally "grassland" soils on which timber has encroached; typified by the Katy series.	95	-	80*	Slight	Severe	Mod.	None to Slight	Slight	Slight	Loblolly, Longleaf, and Slash pines.
3 - CO	Moderately coarse, rapidly permeable soils, with water tables furnishing adequate moisture throughout the year; typified by Sabine loamy fine sand.	90	-	-	Mod.	Mod.	Mod.	None to Slight	Slight	Mod.	Loblolly and Slash pines.
4 - CO	Moderately coarse textured, soils with moderate to excessive internal drainage; originally "grassland" soils on which timber has encroached; typified by Hockley loamy fine sand.	85	-	-	Mod. to Severe	Mod.	Slight	None to Slight	Slight	Mod.	Loblolly and Slash pines.
5 - CO	Artificially drained soils that originally were ponded and unsuited for timber growth; medium textured and slowly permeable; typified by the Waller series.	105	-	-	Mod.	Severe	Severe	None to Slight	Mod.	Slight	Loblolly and Slash pines.

1/ The narrative for each group lists all of the soils that are included.

2/ Until information is available it is assumed that these values for loblolly pine represent a close approximation for slash pine.

3/ Values marked by an asterisk (*) have been assigned or adjusted (see text).

4/ Where a dash (-) is shown, no data is available. The species concerned is not prevalent on these soils.

Woodland Suitability Group 1 - CO

These are imperfectly to moderately well drained mostly fine and medium textured, very slowly and slowly permeable soils of the Coast Prairie. Timber has encroached on these soils. The nearly level relief and slowly to very slowly permeable subsoils cause these soils to be wet-natured during the rainy season. The soils supply adequate moisture and plant nutrients for rather high production of pine timber. Rainfall usually is well distributed throughout the year.

The soils in the group are:

Beaumont clay
Bernard clay loam
Edna clay loam
Edna fine sandy loam
Edna very fine sandy loam

Site index is 90 for loblolly pine. Shortleaf pine usually is not found on these soils. Stands of longleaf pine adequate for sampling were not found, but a site index of 85 was assigned on the basis of measurements made on the loblolly pine. For overstocked, unmanaged stands of age 50 years, the soils can be expected to produce an average annual growth per acre of about 555 board feet for loblolly pine and 415 board feet for longleaf pine (Scribner, Fig. 8).

Plant competition is considered moderate on the Bernard clay loam, which usually is slightly higher and better drained than the other soils of the group. The competition is severe on the other less well drained soils, when seed sources of competitive trees are available. Moderate competition may delay, but usually does not prevent establishment of an adequate stand. Some site preparation may be needed. Where the problem is severe, natural regeneration cannot be relied on to provide adequate restocking. Special management practices and site preparation are usually necessary, such as prescription burning, use of chemicals, girdling, tree planting, and some replanting.

Equipment limitation is severe on these imperfectly drained to moderately well drained soils with clay at or near the surface. Severe damage to tree roots and soil structure, as well as difficulty in hauling operations, is apt to result from use of equipment for a period of about three or four months during winter and spring.

Woodland Suitability Group 2 - CO

These are nearly level, imperfectly drained, mostly thick surfaced, medium textured, slowly and very slowly permeable soils that originally had grass vegetation, but timber has encroached on them. They have rather rapid infiltration rates, store adequate amounts of available moisture, and have adequate natural fertility. They are highly productive for pine.

The soils in this group are:

Clodine very fine sandy loam
Hockley fine sandy loam, imperfectly drained
Katy fine sandy loam
Katy very fine sandy loam

Site index is 95 for loblolly and 80 for longleaf pine. Shortleaf pine does not generally occur on these imperfectly drained soils. In well-stocked, unmanaged stands of age 50 years, the soils should produce an average annual growth per acre of about 625 board feet for loblolly pine, and 350 board feet for longleaf pine (Scribner, Fig. 8).

Plant competition is a severe problem on these imperfectly drained soils when openings are made in the canopy and seed sources of competing vegetation are present. Natural regeneration cannot be relied on to provide adequate restocking. Rather thorough site preparation, such as prescription burning, girdling and use of chemicals, as well as tree planting and some replanting, usually are necessary.

Equipment limitation is moderate on these mostly thick surfaced, medium to moderately coarse textured imperfectly drained soils. Equipment can be used for about 9 months of the year without serious damage to tree roots on the soil, but hauling operations should be withheld during the cool, moist season.

Woodland Suitability Group 3 - CO

This is a rapidly permeable loamy fine sand of the Coast Prairie. It originally supported grass vegetation, but timber has encroached on it. Due to nearly level topography and high seasonal watertable, as well as clayey substratum in reach of tree roots, the soil supplies rather large amounts of available moisture, and is productive for pine.

Sabine loamy fine sand is the only soil in this group.

Site index for loblolly pine is 90. Shortleaf and longleaf pine usually do not occur on this soil. For overstocked, unmanaged stands of age 50 years, the soil can be expected to produce an average annual growth per acre of about 555 board feet for loblolly pine (Scribner, Fig. 8).

Seedling mortality is a moderate problem on this coarse textured soil for both naturally occurring and planted seedlings. The high and rather even distribution of rainfall, and high humidity prevent the problem from being severe. Losses of 25 to 50 percent of seedlings can be expected and natural regeneration cannot be relied on for adequate restocking.

Plant competition is moderate when openings are made in the canopy. Establishment is apt to be delayed and initial growth slowed, but adequate stand establishment usually is not prevented. Seedbed preparation may be advisable in places.

Equipment limitation is moderate. Equipment can be used for more than about 9 months of year without serious damage to tree roots, and without any particular difficulty in operations. Equipment should be withheld during the cool, moist season.

There may be a moderate problem of damage to young trees by gophers on these soils on or near old fields. Control measures should be carried out where pests are present.

Woodland Suitability Group 4 - CO

These are thick surfaced, loamy fine sand and fine sandy loam soils with moderately to rapidly permeable subsoils. They are mostly nearly level to gently sloping, and are moderately well to excessively drained. They are believed to be productive pine sites, although the soils originally supported grass vegetation.

The soils in the group are:

Hockley fine sandy loam
Hockley loamy fine sand
Kenney loamy fine sand

Stands suitable for sampling were not found, but some encroachment of pine has been observed. Site index of 85 for loblolly was assigned on the basis of measurements made on other soils with similar characteristics in the greater than 44-inch rainfall zone of the FC land resource area. Longleaf pine usually does not grow on these soils. For overstocked, unmanaged stands of age 50 years, the soils should produce an average annual growth per acre of about 490 board feet for loblolly pine (Scribner, Fig. 8).

Seedling mortality is considered to be moderate on the Hockley soils, due to the low moisture holding capacity of their sandy, thick surface layers. Losses of 25 to 50 percent can be expected on both naturally occurring and planted seedlings. Some replanting to fill in openings can be expected. Seedling mortality is severe on the Kenney loamy fine sand, due to the low moisture holding capacity and great depth of the surface soil. Natural regeneration cannot usually be relied on, and losses of over 50 percent of planted stock can be expected. Special seedbed preparation, good planting techniques, and good quality planting stock are needed to help in restocking.

Plant competition is moderate when openings are made in the canopy. Some seedbed preparation may be needed to prevent delay in establishment, and to encourage initial growth of pine species.

There is a moderate hazard of gopher damage to young pines, particularly on or near old fields. Leaf-cutting ants may be present and cause moderate damage, particularly on the better drained areas of Hockley and Kenney loamy fine sands. Control measures should be carried out where pests are present.

Woodland Suitability Group 5 - CO

These are poorly drained, clay loam and very fine sandy loam textured, very slowly permeable soils of the Coast Prairie on which partial surface drainage has been provided. The soils occur in shallow depressions in undissected or weakly dissected coastal terrace. Water stands on or near the surface for long periods during the rainy season, unless surface drainage is provided. Encroachment of pine timber occurs only where partial surface drainage has been provided and a seed source is available. These soils are productive pine sites where some surface drainage has been provided.

The soils in the group are:

Waller clay loam, drained phase
Waller very fine sandy loam, drained phase

The average site index is 105 for loblolly pine. Shortleaf and longleaf pine ordinarily do not occur on these soils. For overstocked, unmanaged stands of age 50 years, the soils should produce an average annual growth per acre of about 775 board feet for loblolly pine (Scribner, Fig. 8).

Seedling mortality is considered moderate on these partially drained soil areas, which are wet natured in the rainy season and somewhat droughty to young seedlings during dry summers. Losses of from 25 to 50 percent of seedlings can be expected. Some replanting can be expected.

Plant competition is severe on these soils when seed sources of competing vegetation are present. Natural regeneration cannot be relied on to provide adequate restocking. Special management and site preparation, such as prescribed burning, use of chemicals, girdling, tree planting and replanting usually are necessary.

Equipment limitations are severe, due to poor drainage, depressed position, and high rainfall. Use of equipment should be limited to periods of low rainfall to prevent damage to tree roots and the soil. Graded, well drained roads are needed.

There is a moderate problem of windthrow, because the trees have shallow root systems, and the soils are saturated for long periods. This should be taken into consideration in planning stand density control in intermediate and final harvest cuttings.

REFERENCES

Bennett, W. H., 1961.
Texas Leaf Cutting Ant. Texas Forest Service Circular No. 44, revised July, 1961.

Chandlar, R. F., Jr., P. W. Schoen, and D. A. Anderson. 1943.
Relation between soil types and the growth of loblolly pine and shortleaf pine in East Texas. Jour. For. 41: 505-506.

Coile, T. S., and Schumacher, F. X., 1953.
Relation of soil properties to site index of loblolly and shortleaf pine in the Piedmont Region of the Carolinas, Georgia, and Alabama. Jour. For. 739-744.

Coile, T. S., 1948.
Relation of soil characteristics to site index of loblolly and shortleaf pines in the Piedmont region of North Carolina. Duke Univ. School of Forestry, Bul. 13.

Cooper, W. E., 1942.
Forest site determinations by soil and erosion classification. Jour. Forestry 40: 709-712.

Grano, C. X., 1953.
Wind-firmness of shortleaf and loblolly pines. Southern Lumberman, Dec. 15.

Highway Research Board. 1957.
Agricultural Soil Maps, Status, July 1957. National Academy of Science-National Research Council. Publication 543 (Highway Research Board Bulletin 22-R, a revision of Bulletin 22 issued in 1948).

Hockensmith, Roy D., 1960.
The National Cooperative Soil Survey in the United States. U. S. Dept. Agric., Soil Conservation Service, SCS-TP-138. August.

Kellogg, Charles E., 1961.
Soil interpretations in the soil survey. USDA, Soil Conservation Service. April.

Loftin, L. L. et al. 1959.
Soil survey interpretations for woodland conservation -- Forested Coastal Plain, Western Louisiana -- A progress report. U. S. Dept. Agric., Soil Conservation Service, Alexandria, Louisiana. October.

McClurkin, D. C., 1953.
Soil and climatic factors related to the growth of longleaf pine. U. S. Forest Service, South. For. Exp. Sta., Occasional Paper No. 132. 12 pp (processed).

Society of American Foresters. 1954.
Forest Cover Types of North America (exclusive of Mexico). Washington, D. C.

Texas Forest Service. 1963.
Written communication from A. D. Folweiler, Director.

Turner, L. M.. 1937.
Growth of second-growth pine on the Coastal Plain spils of Arkansas. Ark. Agri. Exp. Sta. Bul. 342.

Turner, L. M.. 1938.
Some profile characteristics of pine-growing soils of the Coastal Plain Region of Arkansas. Ark. Agri. Exp. Sta. Bul. 361.

U. S. Dept. Agri.. 1941.
Climate and Man, Agricultural Yearbook.

U. S. Dept. Agric.. 1951.
Soil Survey Staff. Soil Survey Manual, Handbook No. 18.

U. S. Dept. Agric.. 1929.
Volume, yield and stand tables for second growth southern pines. Misc. Publ. 50.

U. S. Forest Service. 1956.
Forests of East Texas, 1953-55. USDA, Forest Service Southern Forest Experiment Station. Forest Survey Release 77.

Zahner, R.. 1954.
Estimating loblolly pine sites in the Gulf Coastal Plain. Jour. For. 52: 448-449.

Zahner, R.. 1957.
Mapping soils for pine site quality in South Arkansas and North Louisiana. Jour. For. 55: 430-433.

Zahner, R.. 1957a.
Field procedures for soil-site classification of pine land in South Arkansas and North Louisiana. So. For. Exp. Sta., U. S. Forest Service, Occasional Paper 155.

Zahner, R.. 1958.
Site-quality relationships of pine forests in South Arkansas and North Louisiana. Forest Science 4: 156-176.

APPENDIX

Contents

EXPLANATION OF NUMBERED COLUMNS IN APPENDIX TABLES 1 THROUGH 7 AND OF ABBREVIATIONS OF SOIL TEXTURAL CLASSES

Column

(1) Soils are listed by taxonomic units or groups of taxonomic units. The soil unit symbol is part of locally used mapping unit symbols.

(2) Plots were numbered consecutively in each county. The county name or abbreviation follows each sample number.

(3) Slope classes used were as follows:

A	0-1% slopes	D	5-8% slopes
B	1-3% slopes	E	8-12% slopes
C	3-5% slopes	F	12-20%+ slopes

(4) Erosion classes used were as follows:

1. No to slight erosion - Mostly no erosion but up to 25% of the original A horizon removed.
2 Moderate erosion - From 25 to 75% of the original A horizon removed.
3. Moderately severe erosion - 75% or more of the original A horizon removed and may have occasional deep gullies.
4 Severe erosion - All of original A horizon removed over most of the area; may have frequent deep gullies.

(5) Thickness of A horizon, U. S. Dept. of Agriculture, 1951.

(6) Plot position was designated as follows:

L Lower 1/3 of the slope.
M Middle 1/3 of the slope.
U Upper 1/3 of the slope, or ridgetop position.
Lc Footslope or talus position.
N No slope influence; level or nearly level.

(7) Past land use was denoted as: NC - Never Cleared; OF - Old Field.

(8) Average Annual Precipitation: Determined to nearest 2 inch rainfall belt from isohyetal map and plot location, USDA, 1941.

(9) Warm Season Precipitation: Determined in same way as for total annual precipitation, and includes the months of April through September.

(10) Frost Free Period: Average number of days without killing frost, based on isothermal maps and plot locations, USDA, 1941.

(11) Trees Measured: The number of trees measured on each plot from which average site index was determined.

(12) Total Age: The age of a tree was determined by counting rings on increment boring, and adding a constant (see text).

(13) Total Height: Determined by hand level and tape.

(14) dbh: Average diameter at breast height of measured trees, taken with tape and rounded to nearest inch.

(15) Site Index: Derived from average height and age measurements from published site index curves (see text).

Abbreviations for Soil Textural Classes:

c-------clay
cl------clay loam
fs------fine sand
fsl-----fine sandy loam
gfsl----gravelly fine sandy loam
gsl-----gravelly sandy loam
glfs----gravelly loamy fine sand
lfs-----loamy fine sand
scl-----sandy clay loam
sicl----silty clay loam
vfsl----very fine sandy loam

APPENDIX TABLE 1. Soil-site index correlation plot data for loblolly pine. East Texas Timberlands (FC) Area. Sheet 1 of 6

Soil and unit symbol (1)*		Plot number and county (2)	Slope class (3)	Erosion class (4)	Thickness A horizon (5) inches	Plot position (6)	Past land use (7)	Ave. Precipitation: Annual (8) inches	Ave. Precipitation: Warm season (9) inches	Frost-free period (10) days	Trees measured (11) number	Ave. total Age (12) years	Ave. total Height (13) feet	dbh (14) inches	Site index (15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Bibb cl	4ab	86 Montgomery	A	1	14	N	NC	44-46	23	260	4	33	82	15	98
Bibb sicl, frequently flooded	4ab	4g Cherokee	A	1	7	N	NC	44-46	22	245	3	42	92	17	101
Boswell fsl & vfsl	5	18a Sabine	D	1	5	U	NC	46-48	22	235	3	40	79	13	87
		112a Tyler	B	1	14	U	NC	46-48	24	250	3	38	75	15	82
		8b Cherokee	C	1	7	L	NC	44-46	22	245	3	32	69	13	87
		8d Cherokee	C	1	7	Lc	NC	44-46	22	245	3	36	68	14	81
		19 Harrison	C	3	4	U	NC	44-46	22	240	3	44	66	16	71
		9a San Augustine	C	1	5	U	NC	46-48	22	250	4	46	80	17	83
		20b San Augustine	C	1	9	M	NC	46-48	22	235	3	34	63	14	77
		21a San Augustine	E	1	9	M	NC	46-48	22	240	4	42	74	16	80
		4 Sabine	B	1	8	M	NC	46-48	22	235	3	54	86	16	83
		16 Trinity	C	1	4	M	NC	44-46	23	245	4	32	71	14	89
		5 Shelby	B	1	8	M	NC	46-48	22	230	4	50	83	17	83
		25a Harrison	C	1	10	Lc	NC	44-46	22	240	3	38	78	17	88
		24a San Augustine	D	1	6	M	OF	44-46	22	235	4	33	74	15	90
		25 Marion	C	2	12	M	OF	44-46	22	240	4	36	74	15	85
		8a Panola	C	2	3	M	OF	44-46	22	230	4	39	75	13	83
		20a Sabine	D	1	10	M	NC	46-48	22	245	3	35	72	12	84
		110 Angelina	B	1	4	M	OF	46-48	23	245	4	60	88	20	80
Boswell gfsl	5d	6a Angelina	D	1	16	M	NC	44-46	23	245	3	40	80	17	88
		14a Sabine	D	1	6	U	NC	46-48	22	235	4	48	87	16	88
		12a Trinity	C	1	8	L	NC	44-46	23	245	3	33	77	15	93
Boswell gfsl, mod. shallow	5sd	9a Sabine	D	3	2	M	OF	46-48	22	235	3	44	77	18	81
Bowie fsl & vfsl	7	23a Harrison	B	2	16	U	NC	44-46	22	240	3	43	75	19	79
		3b Harrison	C	2	9	M	NC	44-46	22	240	3	40	69	14	76
		9 Trinity	B	1	12	M	NC	44-46	23	250	3	40	74	16	82
Bowie fsl, thick surface	M7	106a Montgomery	B	1	32	N	NC	44-46	23	260	3	47	86	16	88
		10a Sabine	B	1	28	U	NC	46-48	22	235	3	53	88	17	86
		15 San Augustine	D	1	20	U	NC	46-48	22	235	3	51	84	18	84
Bowie vfsl, thick surface	M7	12b San Augustine	B	1	36	U	NC	46-48	22	235	3	31	72	13	91
Bowie lfs	12	8a Polk	D	1	33	M	NC	44-46	23	250	3	58	97	16	91
		18b Jasper	B	1	18	U	OF	46-48	25	245	1	45	87	17	90
		46a Harrison	C	1	18	Lc	OF	44-46	22	240	4	59	86	19	81
		30a Tyler	B	1	24	U	OF	46-48	24	250	3	26	68	12	96
		32a Tyler	B	1	24	L	OF	46-48	24	250	3	35	82	15	98
		32a1 Tyler	C	1	24	L	OF	46-48	24	250	6	36	85	15	98
Byars cl	1a1	1004 Montgomery	A	1	10	N	NC	44-46	23	260	4	43	84	17	89
		1037 Montgomery	A	1	6	N	NC	44-46	23	260	6	33	68	14	83
		187 Montgomery	A	1	18	N	NC	44-46	23	260	4	38	84	14	94
		3 Trinity	A	1	18	N	NC	44-46	23	250	3	53	87	16	86

*Headings of numbered columns are explained on pages 89 and 90.

APPENDIX TABLE 1 (cont'd) Soil-site index correlation plot data for loblolly pine. East Texas Timberlands (FC) Area. Sheet 2 of 6

Soil and unit symbol (1)		Plot number and county (2)		Slope class (3)	Erosion class (4)	Thickness: A horizon (5) inches	Plot position (6)	Past land use (7)	Ave. Precipitation: Annual (8) inches	Ave. Precipitation: Warm season (9) inches	Frost-free period (10) days	Trees measured (11) number	Ave. total Age (12) years	Ave. total Height (13) feet	dbh (14) inches	Site index (15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE																
Byars vfsl, thick surface	M5a	151	Angelina	A	1	18	N	NC	44-46	23	245	3	58	95	19	90
Caddo fsl & vfsl	7a1	21a	Sabine	B	1	18	Lc	NC	48-50	22	235	3	53	81	16	79
		4a	Angelina	B	1	17	M	NC	44-46	23	245	2	51	88	16	87
Caddo fsl, thick surface		41a	Houston	C	1	42	M	NC	44-46	22	250	4	48	85	18	87
Caddo fsl, thick surface		7	Trinity	A	1	35	Lc	NC	44-46	23	250	4	40	90	19	99
		22	Trinity	A	1	26	Lc	NC	44-46	23	250	4	38	80	15	90
Caddo lfs	12a1	8	Bowie	B	1	24	Lc	NC	44-46	21	240	3	26	62	16	87
		15	San Jacinto	B	1	56	M	NC	44-46	23	255	4	48	88	16	89
Caddo lfs, clayey substratum variant	11a1	47	Houston	B	1	28	M	NC	44-46	22	250	4	60	79	18	74
		20	Trinity	D	1	36	M	NC	44-46	23	250	5	41	72	15	78
Conroe gfsl	6sd	16	Montgomery	D	1	14	M	NC	44-46	23	260	4	36	66	12	76
	6d	105	Tyler	C	1	18	M	NC	46-48	24	250	3	56	75	15	72
Conroe glfs	11sd	578a	Montgomery	B	1	17	M	NC	44-46	23	260	3	61	78	17	72
		600	Montgomery	B	1	18	U	NC	44-46	23	260	4	51	77	17	76
		124a	Montgomery	C	1	16	U	NC	44-46	23	260	2	30	57	10	71
		6	Montgomery	B	1	24	U	NC	44-46	23	260	3	36	53	12	61
		197	Montgomery	C	1	25	U	NC	44-46	23	260	4	35	61	13	71
		199	Montgomery	C	1	18	U	OF	44-46	23	260	4	40	65	14	71
		200	Montgomery	D	1	29	M	NC	44-46	23	260	5	58	70	12	67
		541	Montgomery	C	1	14	M	NC	44-46	23	260	4	36	60	13	68
Conroe lfs	11s	25	Montgomery	B	1	22	M	NC	44-46	23	260	4	31	60	11	76
		125	Montgomery	C	1	20	M	NC	44-46	23	260	5	47	73	17	75
		152	Montgomery	B	1	18	M	NC	44-46	23	260	3	48	70	16	72
		156	Montgomery	B	1	21	U	NC	44-46	23	260	5	32	61	13	76
		167	Montgomery	C	1	18	L	OF	44-46	23	260	5	44	76	14	80
		198	Montgomery	B	1	21	U	NC	44-46	23	260	4	41	65	13	71
		202	Montgomery	B	1	18	M	OF	44-46	23	260	5	33	64	14	78
		519	Montgomery	B	1	18	M	NC	44-46	23	260	5	50	76	12	76
		546	Montgomery	B	1	26	U	NC	44-46	23	260	4	37	69	14	78

APPENDIX TABLE 1 (cont'd) Soil-site index correlation plot data for loblolly pine. East Texas Timberlands (FC) Area.

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	dbh	Site index
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
					inches			inches	inches	days	number	years	feet	inches	
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Cuthbert fsl	6	9 Bowie	F	3	8	M	NC	44-46	21	240	3	26	58	13	81
		13a Angelina	E	3	16	M	OF	44-46	23	245	5	32	65	14	81
Cuthbert fsl, mod. shallow	6s	19c Tyler	C	1	12	U	NC	46-48	24	250	3	39	66	14	73
		19b Tyler	C	1	12	U	NC	46-48	24	250	3	40	62	11	67
Cuthbert lfs	11	31 Montgomery	D	2	30	M	NC	44-46	23	260	3	31	63	14	80
		563a Montgomery	E	1	20	M	NC	44-46	23	260	4	39	71	17	79
		200 San Jacinto	F	1	36	M	NC	44-46	23	255	3	41	71	15	78
Eustis fs	13	3a San Augustine	C	2	66	M	OF	46-48	22	235	3	44	73	15	86
Garner c	1	1003 Montgomery	B	1	8	M	NC	44-46	23	260	3	51	72	16	72
		1005 Montgomery	B	1	3	M	NC	44-46	23	260	4	35	69	14	80
		1006 Montgomery	B	1	8	M	NC	44-46	23	260	5	59	78	15	74
		1011 Montgomery	A	1	7	N	NC	44-46	23	260	5	53	75	15	73
		1041 Montgomery	A	1	4	N	NC	44-46	23	260	4	37	64	12	74
		157 Montgomery	B	1	4	L	OF	44-46	23	260	5	32	64	12	78
		164a Montgomery	A	1	6	N	NC	44-46	23	260	5	45	69	16	72
Iuka cl, clay substratum variant	4b	8 Sabine	A	1	16	N	NC	46-48	22	235	3	38	99	19	111
Iuka cl, occas. flooded	4X	13 San Augustine	A	1	17	N	NC	46-48	22	235	5	34	91	19	108
		14 San Augustine	A	1	5	N	NC	46-48	22	235	4	34	92	17	110
Iuka fsl, frequently flooded	9b	6 Tyler	A	1	60+	N	NC	46-48	24	250	4	43	105	16	112
		7 Tyler	A	1	60+	N	NC	46-48	24	250	5	42	101	16	108
Iuka fsl, clay substratum variant	8b	7a Cherokee	A	1	10	N	NC	44-46	22	255	3	46	108	17	111
Iuka vfsl, clay substratum variant	8	22 Sabine	A	1	11	N	OF	46-48	22	235	5	37	94	17	108
		105 Angelina	A	1	28	N	NC	46-48	23	245	3	33	86	15	106
Kirvin fsl	6	5 Panola	C	1	11	M	OF	46-48	22	230	4	35	78	16	91
		10 Panola	E	3	7	M	OF	44-46	22	230	5	36	76	16	90
Kirvin gfsl	6d	17a Harrison	F	1	17	L	NC	44-46	22	240	3	38	76	16	87
Kirvin gfsl, mod. shallow	6sd	18c Tyler	C	1	10	U	NC	46-48	24	250	1	42	58	15	62
Kirvin lfs	11	22 Harrison	B	1	20	M	NC	44-46	22	240	3	46	76	17	79
Klej lfs	13	300 San Jacinto	A	1	42	N	NC	44-46	23	255	3	41	82	13	88
		301 San Jacinto	A	1	42	N	NC	44-46	23	255	3	40	76	13	83
		25 San Jacinto	B	1	72	U	OF	44-46	23	255	4	34	80	15	95
Lakeland fs	13	5b Harrison	F	1	66	Lc	NC	44-46	22	240	4	35	76	13	89
		11 San Jacinto	B	1	41	M	NC	44-46	23	255	3	48	82	14	83

4-17609 Rev. 3-64

APPENDIX TABLE 1 (cont'd) Soil-site index correlation plot data for loblolly pine. East Texas Timberlands (FC) Area. Sheet 4 of 6

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon	Plot position	Past land use	Ave. Precipitation Annual	Ave. Precipitation Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	dbh	Site index
(1)		(2)	(3)	(4)	(5) inches	(6)	(7)	(8) inches	(9) inches	(10) days	(11) number	(12) years	(13) feet	(14) inches	(15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Lakeland lfs	13	155 Montgomery	C	1	36	M	OF	44-46	23	260	4	28	66	13	87
		517 Montgomery	B	1	37	M	OF	44-46	23	260	5	35	71	16	82
		113 Tyler	B	1	47	M	NC	46-48	24	250	4	37	79	15	89
Lakeland lfs, mod. shallow	13s	123 Montgomery	B	1	44	U	NC	44-46	23	260	1	54	67	16	65
Magnolia fsl	7	16 San Jacinto	B	1	14	M	NC	46-48	23	255	3	42	77	15	81
Magnolia fsl, terrace phase	7	10 Hardin	B	1	19	N	OF	50-52	26	265	4	30	82	11	105
		27 Nacogdoches	B	1	13	M	NC	46-48	22	240	5	39	99	18	110
		26b Nacogdoches	B	1	18	U	OF	46-48	22	240	4	41	92	16	101
Plummer lfs, clay substratum variant	10al	8a Angelina	C	1	38	U	OF	44-46	23	245	5	39	81	16	89
Rains fsl, clay substratum variant	M5al	6a Trinity	B	1	41	M	NC	44-46	23	250	3	48	78	15	79
Ruston fsl, terrace phase	7	12a Sabine	D	1	17	M	OF	46-48	22	235	4	32	79	17	98
Ruston fsl, thick surface	M7	10 Nacogdoches	C	1	23	M	NC	46-48	22	240	3	55	98	18	94
		27 Marion	C	1	20	M	NC	44-46	22	240	3	73	105	17	93
Ruston lfs	12	28 Polk	D	1	36	M	NC	46-48	23	250	4	57	83	16	90
		33a Nacogdoches	D	3	16	M	OF	46-48	22	240	4	38	80	17	90
		34a Nacogdoches	D	2	19	M	OF	46-48	22	240	3	41	91	18	99
		110 Tyler	F	1	22	M	OF	46-48	24	250	4	52	99	16	98
		7 Bowie	C	1	20	M	OF	44-46	21	240	2	25	56	17	82
Ruston lfs, terrace phase	12	32b Tyler	D	1	27	M	OF	46-48	24	250	3	32	75	12	94
		32b1 Tyler	D	1	27	M	OF	46-48	24	250	5	33	76	13	94
Sawyer fsl & vfsl	6	139 Montgomery	B	1	15	M	OF	44-46	23	260	4	38	80	14	90
		140 Montgomery	B	1	14	M	NC	44-46	23	260	6	41	78	15	87
		142 Montgomery	A	1	18	N	NC	44-46	23	260	6	29	66	15	87
		1010 Montgomery	B	1	7	M	NC	44-46	23	260	6	58	84	16	80
		1034 Montgomery	B	1	10	M	OF	44-46	23	260	5	31	75	14	93
		17 Trinity	B	1	10	U	NC	44-46	23	250	4	33	71	15	87
		4a Cherokee	B	1	16	U	NC	44-46	22	245	3	40	76	17	83
		46 Houston	B	1	8	M	NC	44-46	22	250	3	45	84	17	87
		48 Houston	B	1	8	L	NC	44-46	22	250	5	46	78	16	80
		107a Angelina	C	1	14	M	NC	44-46	23	245	3	55	91	17	88
		2b Jasper	C	1	6	L	NC	46-48	25	245	2	22	54	16	85
		5 San Augustine	C	2	15	M	NC	46-48	22	235	3	31	66	13	83
		15 Polk	C	1	18	L	OF	44-46	23	250	5	32	78	13	96
		34 Houston	C	1	12	M	OF	44-46	22	250	4	38	83	15	94

4-17609 Rev. 3-64

APPENDIX TABLE 1 (cont'd) Soil-site correlation plot data for loblolly pine. East Texas Timberlande (FC) Area.

Soil and unit symbol (1)		Plot number and county (2)	Slope class (3)	Erosion class (4)	Thickness A horizon (5) inches	Plot position (6)	Past land use (7)	Ave. Precipitation: Annual (8) inches	Ave. Precipitation: Warm season (9) inches	Frost-free period (10) days	Trees measured (11) number	Ave. total Age (12) years	Ave. total Height (13) feet	dbh (14) inches	Site index (15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Sawyer fsl & vfsl, moundy	6-x	3 Panola	B	1	11	M	NC	46-48	22	230	5	35	69	12	82
		7b Panola	B	1	11	M	NC	44-46	22	230	1	42	76	14	81
Sawyer fsl, thick surface	M6	1b Trinity	C	1	32	U	NC	44-46	23	250	3	41	75	15	81
Sawyer lfs	11	141 Montgomery	B	1	24	U	OF	44-46	23	260	6	37	82	15	93
		1007a Montgomery	C	1	15	M	OF	44-46	23	260	4	36	76	15	88
		1019 Montgomery	B	1	17	M	OF	44-46	23	260	5	30	62	12	80
		1020a Montgomery	B	1	17	M	NC	44-46	23	260	3	50	89	18	89
		1021 Montgomery	B	1	31	M	NC	44-46	23	260	5	36	82	15	94
		1022 Montgomery	A	1	27	M	NC	44-46	23	260	5	35	80	17	94
		1028 Montgomery	B	1	19	M	OF	44-46	23	260	5	35	87	16	102
		1039 Montgomery	B	1	12	U	OF	44-46	23	260	5	36	85	15	98
		26 San Jacinto	B	1	22	M	NC	44-46	23	255	3	33	69	14	83
		13 Tyler	C	1	22	M	NC	46-48	24	250	5	48	79	14	81
		2 Tyler	C	1	24	L	NC	46-48	24	250	4	47	85	16	87
		5 Tyler	C	1	17	M	OF	46-48	24	250	4	41	89	19	97
		14 Tyler	C	1	23	M	OF	46-48	24	250	4	34	82	12	98
		14a Tyler	C	2	20	M	OF	46-48	24	250	3	35	82	13	96
Susquehanna fsl	5a1	175 Montgomery	A	1	18	N	OF	44-46	23	260	5	33	78	15	92
		185 Montgomery	A	1	10	N	OF	44-46	23	260	5	35	77	15	91
		150a Angelina	A	1	7	N	NC	44-46	23	245	3	53	81	15	79
	5	116 Montgomery	C	1	7	U	OF	44-46	23	260	4	33	73	17	88
		115 Montgomery	B	1	6	U	NC	44-46	23	260	4	56	79	16	76
		11 Montgomery	B	1	10	M	NC	44-46	23	260	4	34	62	11	75
		29 Trinity	C	1	9	L	NC	44-46	22	250	5	37	74	14	84
		1 Polk	D	2	4	M	NC	44-46	23	250	3	44	80	15	84
		13 Walker	B	1	8	M	NC	44-46	22	260	3	49	78	17	78
		126 Newton	D	1	9	M	NC	48-50	25	245	4	37	67	13	78
		130 Newton	D	1	3	M	NC	50-52	25	245	3	48	84	16	85
		113 Angelina	A	1	9	M	OF	44-46	23	245	3	44	73	14	77
Susquehanna fsl, moundy	5-x	26a San Augustine	B	1	14	M	NC	46-48	22	235	3	46	84	21	87
Susquehanna fsl, thick surface	M5	24 Houston	D	1	31	U	NC	44-46	22	250	4	38	73	16	82
		36a Nacogdoches	E	1	23	M	NC	44-46	22	240	3	57	89	19	85
	M5a1	16 Nacogdoches	B	1	24	M	NC	46-48	22	240	3	32	68	15	83
		17a Nacogdoches	A	1	21	L	OF	46-48	22	240	5	31	76	15	96
		9a Nacogdoches	B	1	26	M	NC	44-46	22	240	3	53	109	19	107
Susquehanna lfs	10	144 Montgomery	B	1	21	M	NC	44-46	23	260	5	32	64	12	78

APPENDIX TABLE 1 (cont'd) Soil-site index correlation plot data for loblolly pine. East Texas Timberlands (FC) Area. Sheet 6 of 6

Soil and unit symbol (1)		Plot number and county (2)		Slope class (3)	Erosion class (4)	Thickness A horizon (5) inches	Plot position (6)	Past land use (7)	Ave. Precipitation: Annual (8) inches	Warm season (9) inches	Frost-free period (10) days	Trees measured: number (11)	Ave. total Age (12) years	Height (13) feet	dbh (14) inches	Site index (15)
ANNUAL PRECIPITATION LESS THAN 44 INCHES																
Boswell fsl	5	20	Harrison	E	3	4	U	NC	42-44	22	240	2	43	74	17	80
		38b	Harrison	D	4	2	M	NC	42-44	22	240	2	38	67	16	76
Bowie fsl	7	61	Montgomery	D	1	13	M	NC	42-44	22	260	4	59	93	16	88
		5b	Morris	G	3	10	M	NC	42-44	20	240	1	54	78	14	76
Bowie fsl, thick surface	M7	3b	Morris	C	1	24	M	NC	42-44	20	240	3	63	95	19	87
		6b	Morris	B	1	36	U	NC	42-44	20	240	1	68	89	16	83
Cuthbert fsl	6	29	Montgomery	D	1	8	M	NC	42-44	22	260	4	50	79	18	79
		17b	Morris	D	2	14	M	NC	42-44	20	240	3	35	65	13	77
Eustis fs	13	101b	Cherokee	C	1	48	M	NC	40-42	22	245	1	33	58	12	70
Iuka fsl, frequently flooded	9alb	3	Anderson	A	1	60+	N	NC	38-40	21	250	2	34	91	20	109
	& 9b	6	Smith	A	1	60+	N	NC	40-42	20	240	3	32	79	19	98
Kirvin fsl	6	4	Morris	F	1	8	U	NC	42-44	20	240	2	51	77	14	76
		9b	Morris	F	1	8	L	NC	42-44	20	240	3	65	92	20	84
Lakeland lfs	13	5a	Anderson	B	1	60	U	NC	38-40	21	250	4	46	69	16	71
		5b	Anderson	E	1	98	M	NC	38-40	21	250	3	41	71	16	77
		2a	Smith	C	1	72	M	NC	40-42	20	240	2	54	70	14	68
Nacogdoches fsl	6	102b	Cherokee	F	1	9	M	NC	40-42	22	245	3	39	66	16	73
Ochlockonee fsl	9b	8c	Anderson	A	1	60	N	NC	38-40	21	250	3	54	100	19	97
Ruston lfs	12	10b	Cass	C	2	34	Lc	NC	38-40	21	240	5	46	77	13	80
Sawyer fsl	6	104	Smith	B	1	18	M	NC	40-42	20	240	2	37	62	16	72
		8a	Anderson	A	1	15	U	NC	38-40	21	250	3	76	88	20	77
Sawyer fsl & vfsl, moundy	6-x	11b	Red River	B	1	26	U	NC	42-44	22	240	2	44	79	18	83
		16b	Red River	B	1	10	U	NC	42-44	22	240	2	82	93	21	80
		2	Red River	A	1	7	U	NC	42-44	22	240	4	53	76	16	74
Sawyer fsl, thick surface	M6	7	Red River	C	1	20	Lc	NC	42-44	22	240	3	32	63	13	78
Sawyer lfs	11	189	Montgomery	B	1	18	M	NC	42-44	22	260	4	46	84	17	87
		193a	Montgomery	B	1	18	M	NC	42-44	22	260	4	42	83	14	89
Susquehanna fsl, thick surface	M5	6	Red River	C	1	20	U	NC	42-44	22	240	4	32	66	15	80

4-17609 Rev. 3-64

APPENDIX TABLE 2. Soil-site index correlation plot data for shortleaf pine. East Texas Timberlands (FC) Area. Sheet 1 of 8

Soil and unit symbol (1)*		Plot number and county (2)	Slope class (3)	Erosion class (4)	Thickness: A horizon (5) inches	Plot position (6)	Past land use (7)	Ave. Precipitation: Annual (8) inches	Ave. Precipitation: Warm season (9) inches	Frost-free period (10) days	Trees measured (11) number	Ave. total Age (12) years	Ave. total Height (13) feet	dbh (14) inches	Site index (15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Boswell fsl & vfsl	5	11 Trinity	D	1	12	M	NC	44-46	23	255	4	47	76	14	78
		8a Cherokee	B	1	7	U	NC	44-46	22	245	2	34	61	12	76
		8c Cherokee	C	1	7	Lc	NC	44-46	22	245	2	35	64	11	77
		8e Cherokee	C	1	7	Lc	NC	44-46	22	245	3	48	69	12	77
		4 Bowie	C	2	8	L	NC	44-46	21	240	3	32	54	12	69
		11 San Augustine	D	1	9	U	NC	46-48	22	235	4	35	61	10	74
		21b San Augustine	E	1	9	U	NC	46-48	22	240	5	47	71	13	74
		17 Sabine	E	1	9	M	NC	46-48	22	235	6	39	60	12	68
		7 San Augustine	D	1	10	M	NC	46-48	22	245	3	79	91	16	75
		20a San Augustine	C	1	9	M	NC	46-48	22	235	5	33	57	11	71
		18b Sabine	D	1	5	U	NC	46-48	22	235	3	40	73	12	82
		24b San Augustine	D	1	6	M	OF	46-48	22	235	6	31	67	12	85
		8 Shelby	D	1	12	M	OF	46-48	22	230	6	54	74	12	75
		2 Newton	C	1	6	M	OF	48-50	25	245	4	51	87	15	86
		8b Panola	C	2	3	M	OF	44-46	22	230	6	38	67	12	77
		108 Angelina	E	1	13	U	NC	46-48	23	245	3	58	80	14	74
		109 Angelina	C	1	13	U	NC	46-48	23	245	4	58	78	15	73
		15 Sabine	C	1	6	U	NC	46-48	22	235	4	32	53	10	67
		14 Nacogdoches	A	1	9	N	NC	46-48	22	240	3	41	63	13	70
		16 Sabine	D	2	3	M	NC	46-48	22	235	5	34	59	11	73
		20b Sabine	D	1	10	L	NC	46-48	22	245	3	38	68	10	79
		9 Shelby	D	2	6	M	NC	46-48	22	230	4	52	74	13	72
		12 Angelina	D	2	5	M	OF	44-46	23	245	6	33	64	12	79
Boswell gfsl	5d	42 Houston	E	1	17	U	NC	44-46	22	245	4	46	73	14	76
		14b Sabine	D	1	6	U	NC	46-48	22	235	4	48	78	13	80
		12b Trinity	C	1	8	L	NC	44-46	23	245	3	33	73	14	90
		6b Angelina	D	1	16	M	NC	44-46	23	245	3	42	71	13	78
Boswell gfsl, mod. shallow	5sd	30 Nacogdoches	B	1	5	U	NC	44-46	22	240	5	45	62	11	66
		31 Nacogdoches	D	1	21	M	NC	44-46	22	240	6	45	62	11	66
		32 Nacogdoches	D	1	11	M	NC	44-46	22	240	6	53	63	12	61
		27 San Augustine	B	1	11	U	NC	46-48	22	235	5	64	71	13	62
		9b Sabine	D	3	2	M	OF	46-48	22	235	3	44	69	12	73
		7 Angelina	D	1	7	U	NC	44-46	23	245	3	64	67	13	60
Boswell scl, severely eroded	1	25 Nacogdoches	D	4	0	M	OF	44-46	22	240	4	41	68	13	76

*Headings of numbered columns explained on pages 89 and 90.

APPENDIX TABLE 2 (cont'd) Soil-site index correlation plot data for shortleaf pine. East Texas Timberlands (FC) Area. Sheet 2 of 8

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon inches	Plot position	Past land use	Ave. Precipitation Annual inches	Ave. Precipitation Warm season inches	Frost-free period days	Trees measured number	Ave. total Age years	Ave. total Height feet	dbh inches	Site index
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Bowie fsl & vfsl	7	23b Harrison	B	2	16	U	NC	44-46	22	240	1	53	80	19	77
		3a Harrison	C	2	9	M	NC	44-46	22	240	2	47	71	13	73
		37 Houston	C	1	15	M	NC	44-46	22	250	4	52	75	13	74
		3 Bowie	D	1	20	Lc	NC	44-46	21	240	3	41	68	12	75
		3 Shelby	C	1	14	Lc	NC	46-48	22	230	5	69	83	17	75
		18 Polk	B	1	16	U	OF	46-48	23	250	3	41	71	13	78
		19b Sabine	B	1	18	U	NC	46-48	22	235	5	60	88	17	81
Bowie fsl, thick surface	M7	22 Nacogdoches	B	1	27	U	NC	44-46	22	240	4	33	61	12	77
		10b Sabine	B	1	28	U	NC	44-46	22	235	4	64	87	16	78
		28 Nacogdoches	C	1	20	M	OF	46-48	22	240	4	41	80	14	89
		106b Montgomery	B	1	32	N	NC	44-46	23	260	4	51	87	15	85
Bowie vfsl, thick surface	M7	12a San Augustine	B	1	36	U	NC	46-48	22	235	3	33	73	11	89
Bowie lfs	12	5 Angelina	D	1	28	M	NC	46-48	23	245	5	31	57	10	74
		7 Harrison	D	1	36	M	NC	46-48	22	240	5	61	83	15	75
		9b Harrison	D	1	24	M	NC	46-48	22	240	5	34	61	12	76
		104 Tyler	C	1	18	M	NC	46-48	24	250	3	63	90	15	80
		13 Shelby	B	1	31	U	NC	46-48	22	230	4	46	68	11	72
		8b Polk	D	1	33	M	NC	44-46	23	250	3	58	92	15	85
		18a Jasper	B	1	18	U	OF	46-48	25	245	5	50	80	14	80
		46b Harrison	C	1	18	Lc	OF	44-46	22	240	3	60	82	14	74
		10 Shelby	D	1	18	Lc	OF	46-48	22	230	5	42	72	15	79
		30b Tyler	B	1	26	U	OF	46-48	24	250	2	28	63	13	86
Caddo fsl & vfsl	7a1	4a Trinity	B	1	20	U	NC	44-46	23	250	3	49	81	16	82
		21b Sabine	B	1	18	Lc	NC	48-50	22	235	2	57	83	17	77
		4b Angelina	B	1	17	M	NC	44-46	23	245	3	66	81	15	71
Caddo fsl, mod. shallow	M7sal	9b Angelina	C	1	39	U	NC	44-46	23	245	5	70	81	15	69
		33 Houston	B	1	26	M	NC	44-46	22	250	5	42	65	13	71
		14 Trinity	B	1	24	M	NC	44-46	23	250	4	60	74	14	67
Conroe glfe	11sd	578b Montgomery	B	1	17	M	NC	44-46	23	260	1	61	66	12	59
		601 Montgomery	B	1	14	U	NC	44-46	23	260	4	49	65	11	66
		124b Montgomery	C	1	16	U	NC	44-46	23	260	3	65	61	13	53
Cuthbert fsl	6	11 Sabine	E	1	8	M	NC	46-48	22	235	6	40	73	13	81
		13b Angelina	E	3	16	M	OF	44-46	23	245	3	34	60	14	74
		44 Harrison	D	1	7	M	OF	44-46	22	240	6	49	68	13	69
		20 Nacogdoches	E	3	21	M	NC	46-48	22	240	5	34	61	12	75

APPENDIX TABLE 2 (cont'd) Soil-site index correlation plot data for shortleaf pine. East Texas Timberlands (FC) Area.

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	dbh	Site index
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
					inches			inches	inches	days	number	years	feet	inches	
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Cuthbert fsl, mod. shallow	6s	19a Tyler	C	1	12	U	NC	46-48	24	250	3	52	65	13	64
		$19b_1$ Tyler	C	1	12	U	NC	46-48	24	250	3	44	60	11	63
Cuthbert gsl, mod. shallow	6sd	42 Harrison	F	1	10	M	NC	44-46	22	240	5	72	76	16	64
Cuthbert lfs	11	119 Montgomery	E	1	28	M	NC	44-46	23	260	5	64	83	15	73
		563b Montgomery	E	1	20	M	NC	44-46	23	260	4	34	59	13	71
		5b Cherokee	E	1	20	M	NC	44-46	22	245	2	84	87	15	69
		6 Nacogdoches	G	1	21	M	NC	44-46	22	240	3	62	84	14	76
		3 Rusk	C	1	27	U	NC	44-46	22	240	7	42	67	12	73
		7 Shelby	A	1	31	U	OF	46-48	22	230	5	55	80	15	77
		200 Walker	C	1	36	M	NC	44-46	22	270	4	49	67	12	67
Eustis lfs & fs	13	24 Nacogdoches	E	1	54	Lc	OF	44-46	22	240	3	53	86	14	84
		1 San Augustine	F	1	62	M	NC	46-48	22	235	4	41	71	14	78
		39 Nacogdoches	D	1	72	M	NC	46-48	22	240	6	49	69	14	70
		2 San Augustine	F	1	62	M	OF	46-48	22	235	4	42	77	15	84
		3b San Augustine	C	2	66	M	OF	46-48	22	235	3	39	72	13	82
Garner c	1	164b Montgomery	A	1	6	N	NC	44-46	23	260	3	42	59	13	64
Iuka fsl, clay substratum variant	8b	7b Cherokee	A	1	10	N	NC	44-46	22	245	3	49	101	17	100
Kirvin fsl	6	4b Newton	C	1	11	M	NC	52-54	25	245	3	42	70	16	77
		102 Tyler	C	1	12	M	NC	46-48	24	250	3	68	93	15	80
		19 Nacogdoches	D	1	16	U	NC	46-48	22	240	6	34	68	12	83
		11 Harrison	E	1	20	M	NC	44-46	22	240	3	43	68	12	74
Kirvin gfsl	6d	17b Harrison	F	1	17	Lc	NC	44-46	22	240	5	44	74	15	79
		48 Harrison	D	1	12	U	NC	44-46	22	240	5	45	68	13	71
		47 Harrison	F	1	18	L	NC	44-46	22	240	5	45	72	13	76
Kirvin gfsl, mod. shallow	6sd	18b Tyler	C	1	10	U	NC	46-48	24	250	2	47	58	11	60
Kirvin lfs	11	8 Harrison	C	1	24	U	NC	44-46	22	240	4	38	67	12	76
		13 Harrison	F	1	24	M	NC	44-46	22	240	3	72	84	19	71
Lakeland fs	13	103 Tyler	G	1	54	U	NC	46-48	24	250	3	70	86	14	73
		5a Harrison	F	1	66	Lc	NC	44-46	22	240	4	35	72	13	86
		128 Newton	C	1	56	M	NC	48-50	25	245	4	46	79	15	83
Lakeland fs, very deep phase	M13	24 San Jacinto	C	1	82+	U	NC	44-46	23	255	4	54	69	12	66
Lakeland lfs	13	574 Montgomery	B	1	63+	M	OF	44-46	23	260	5	42	78	15	85
		5a Cherokee	E	1	50	U	NC	44-46	22	245	3	76	90	14	75
		31 Houston	C	1	60	M	NC	44-46	22	250	4	33	55	12	69
		2 Nacogdoches	B	1	68	U	NC	46-48	22	240	3	52	72	13	71
		3a Nacogdoches	E	1	68	M	NC	46-48	22	240	4	50	73	12	72
		4 Nacogdoches	D	1	64	Lc	NC	46-48	22	240	3	69	91	14	79
		5 Nacogdoches	B	1	64	U	NC	46-48	22	240	3	73	86	14	73
Lakeland lfs, mod. shallow	13s	201 Montgomery	B	1	44	M	NC	44-46	23	260	5	49	61	11	61
		127 Montgomery	B	1	34	N	NC	44-46	23	260	4	65	67	14	58
		123 Montgomery	B	1	44	U	NC	44-46	23	260	5	53	60	13	58

Soil and unit symbol (1)		Plot number and county (2)		Slope class (3)	Erosion class (4)	Thickness: A horizon (5) inches	Plot position (6)	Past land use (7)	Ave. Precipitation: Annual (8) inches	Warm season (9) inches	Frost-free period (10) days	Trees measured (11) number	Ave. total Age (12) years	Height (13) feet	dbh (14) inches	Site index (15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE																
Magnolia fsl, terrace phase	7	10	San Augustine	A	1	19	U	NC	46-48	22	235	3	53	93	15	90
		26a	Nacogdoches	B	1	18	U	OF	46-48	22	240	5	41	85	14	94
Nacogdoches fsl	6	2c	Cherokee	E	1	20	M	NC	44-46	22	245	3	54	66	12	63
		12	Nacogdoches	C	1	8	M	OF	44-46	22	240	4	64	68	16	78
		13	Nacogdoches	D	1	8	M	OF	44-46	22	240	3	64	58	18	78
Nacogdoches gfsl	6d	2a	Cherokee	D	1	12	L	NC	44-46	22	245	3	52		13	67
Plummer lfs, clay substratum variant	10a1	8b	Angelina	C	1	38	U	OF	44-46	23	245	5	41	72	13	80
Rains fsl, clay substratum variant	M5a1	6b	Trinity	B	1	41	M	NC	44-46	23	250	3	47	74	13	76
Ruston fsl, terrace phase	7	12b	Sabine	D	1	17	M	OF	46-48	22	235	2	31	74	11	94
Ruston fsl, thick surface	M7	2	Harrison	D	3	34	Lc	NC	44-46	22	240	3	57	78	11	74
		29	Nacogdoches	D	1	40	U	NC	44-46	22	240	6	34	74	12	86
Ruston lfs	12	556	Montgomery	B	1	28	M	NC	44-46	23	260	3	42	74	13	80
		129	Newton	E	1	23	M	NC	48-50	25	245	3	42	68	12	75
		31b	Tyler	C	1	28	U	OF	46-48	24	250	3	31	62	13	79
		2	Polk	D	1	33	U	NC	44-46	23	250	3	47	68	14	71
		33b	Nacogdoches	D	3	16	M	OF	44-46	22	240	3	40	75	13	85
		34b	Nacogdoches	D	2	19	M	OF	44-46	22	240	4	50	86	15	87
		27	Polk	C	1	22	U	NC	46-48	23	250	4	45	73	13	77
		101	Tyler	C	1	30	L	NC	46-48	24	250	4	39	78	14	89
Sawyer fsl & vfsl	6	1b	Bowie	C	2	10	M	NC	44-46	21	240	1	35	64	10	76
		8	Trinity	B	1	4	M	NC	44-46	23	250	4	51	79	14	78
		45	Houston	C	1	10	M	NC	44-46	22	250	3	57	88	15	82
		4b	Cherokee	B	1	16	U	NC	44-46	22	245	3	39	67	13	74
		107b	Angelina	C	1	14	M	NC	44-46	23	245	3	64	93	17	82
		4	Shelby	C	1	18	M	NC	46-48	22	230	4	55	81	16	78
		150	Nacogdoches	B	1	11	M	NC	46-48	22	240	3	43	69	14	76
Sawyer fsl & vfsl, moundy	6-x	25	San Augustine	B	1	13	M	NC	46-48	22	235	7	41	63	11	71
		18	Nacogdoches	B	1	13	U	NC	46-48	22	240	6	43	68	13	73
		11	Nacogdoches	B	1	7	M	NC	46-48	22	240	3	64	85	16	76
		7a	Panola	B	1	11	M	NC	44-46	22	230	3	46	70	13	73
Sawyer fsl, thick surface	M6	3	Angelina	C	1	25	L	NC	44-46	23	245	4	68	92	17	80
		24b	Marion	C	1	25	Lc	NC	44-46	22	240	2	39	66	12	75
		1a	Trinity	C	1	32	U	NC	44-46	23	250	3	41	71	12	79

APPENDIX TABLE 2 (cont'd) Soil-site index correlation plot for shortleaf pine. East Texas Timberlands (FC) Area. Sheet 5 of 8

Soil and unit symbol		Plot number and county		Slope class	Erosion class	Thickness A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	dbh	Site index
(1)		(2)		(3)	(4)	(5) inches	(6)	(7)	(8) inches	(9) inches	(10) days	(11) number	(12) years	(13) feet	(14) inches	(15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE																
Sawyer lfs	11	1007b	Montgomery	C	1	15	M	OF	44-46	23	260	3	36	64	12	76
		1009	Montgomery	B	1	23	M	OF	44-46	23	260	6	37	58	12	69
		1020b	Montgomery	B	1	17	M	NC	44-46	23	260	3	56	82	14	77
		38	Houston	B	1	21	M	NC	44-46	22	250	4	53	71	13	68
		27	Trinity	D	1	24	U	NC	44-46	23	250	4	35	66	12	79
Susquehanna fsl	5	1036	Montgomery	C	1	10	M	OF	44-46	23	260	4	32	65	13	81
		4	San Augustine	D	1	12	M	NC	46-48	22	235	5	41	64	12	71
		3	Polk	D	1	7	U	NC	44-46	23	250	4	49	72	13	73
		3	Sabine	B	1	12	M	NC	46-48	22	235	4	57	78	14	73
	5a1	150b	Angelina	A	1	7	N	NC	44-46	23	245	3	56	73	12	69
Susquehanna fsl, moundy	5-x	26b	San Augustine	B	1	14	M	NC	46-48	22	235	6	43	77	13	83
Susquehanna fsl, thick surface	M5	36b	Nacogdoches	E	1	23	M	NC	44-46	22	240	6	57	88	16	83
	M5a1	17b	Nacogdoches	A	1	21	L	OF	46-48	22	240	4	31	70	12	90
		9b	Nacogdoches	B	1	26	M	NC	44-46	22	240	1	74	102	15	86
Susquehanna lfs	10	43	Houston	D	1	16	M	NC	44-46	22	250	5	47	68	14	70
		23	San Jacinto	C	1	22	M	NC	44-46	23	255	3	36	58	14	69
		18	Trinity	C	1	25	U	NC	44-46	23	250	5	47	65	13	68
ANNUAL PRECIPITATION LESS THAN 44 INCHES																
Boswell fsl	5	1a	Wood	D	1	16	U	NC	40-42	20	240	4	58	67	13	62
		1b	Wood	E	3	16	U	NC	40-42	20	240	3	64	64	12	57
		9b	Smith	E	2	10	U	NC	40-42	21	245	4	33	48	11	60
		1c	Wood	D	2	16	M	NC	40-42	20	240	4	64	71	11	63
		3	Camp	B	1	6	U	NC	42-44	20	240	3	36	53	10	62
		9a	Cherokee	C	1	10	U	NC	42-44	21	240	3	67	80	16	70
		38a	Harrison	D	4	2	M	NC	42-44	22	240	2	42	60	14	65
		3	Titus	C	3	4	M	NC	42-44	20	240	2	30	50	10	66
		18	Morris	D	2	6	M	NC	42-44	20	240	3	53	64	11	62
		9c	Cherokee	D	1	18	Lc	NC	42-44	21	240	3	50	71	12	71
		12b	Houston	D	1	16	M	NC	42-44	22	245	3	70	76	14	65
Boswell fsl, mod. shallow	5s	100	Cherokee	F	1	12	U	NC	40-42	22	245	4	54	64	14	61
		3	Upshur	B	1	9	U	NC	40-42	20	240	3	49	61	12	62
Bowie fsl	7	9b	Anderson	E	1	15	M	NC	40-42	21	250	3	52	78	14	76
		17	Cass	C	1	12	M	NC	42-44	21	240	6	42	60	11	66
		34	Harrison	C	1	10	U	NC	42-44	22	240	3	37	66	11	76
		2	Morris	B	1	10	M	NC	42-44	20	240	3	48	73	13	74
		5a	Morris	G	3	10	M	NC	42-44	20	240	2	53	74	15	71

4-17609 Rev. 3-64

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon (inches)	Plot position	Past land use	Ave. Precipitation: Annual (inches)	Warm season (inches)	Frost-free period (days)	Trees measured (number)	Ave. total Age (years)	Height (feet)	dbh (inches)	Site index
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
ANNUAL PRECIPITATION LESS THAN 44 INCHES															
Bowie fsl, mod. shallow	M7s	4a Anderson	B	1	28	U	NC	38-40	21	250	3	42	60	13	66
Bowie fsl, thick surface	M7	10 Anderson	B	1	26	U	NC	40-42	21	250	3	62	87	14	77
		3a Morris	C	1	24	M	NC	42-44	20	240	3	54	85	15	81
		6a Morris	B	1	36	U	NC	42-44	20	240	3	62	86	14	78
Bowie lfs	12	1c Cherokee	B	1	32	L	NC	42-44	22	245	3	50	82	18	82
		7 Smith	D	2	18	L	NC	40-42	20	240	4	46	68	17	71
		10b Cherokee	C	1	36	M	NC	40-42	22	245	3	73	89	14	75
		10c Cherokee	C	1	24	Lc	NC	40-42	22	245	3	71	84	13	71
		19a Morris	B	1	30	U	NC	42-44	20	240	2	45	64	11	68
		5 Upshur	C	2	18	L	NC	40-42	20	240	2	39	63	16	70
		2b Wood	D	1	20	L	NC	40-42	20	240	3	52	70	13	69
		11b Anderson	B	1	24	U	OF	40-42	21	250	3	48	83	13	84
		7 Cass	D	1	18	M	OF	42-44	21	240	3	52	77	13	76
		8 Smith	B	1	18	M	OF	40-42	20	240	4	33	63	11	79
		11 Cass	B	1	19	U	OF	42-44	21	240	3	37	68	13	78
Bub gfsl	19d	2b Cherokee	B	1	10	U	NC	42-44	22	245	3	50	69	12	58
Byars fsl	5	1 Morris	B	1	8	U	NC	42-44	20	240	2	40	60	12	68
Caddo lfs	12a1	12c Houston	B	1	36	Lc	NC	42-44	22	250	3	73	89	19	75
Caddo vfsl, mound phase	7a1-x	12 Red River	B	1	7	Lc	NC	42-44	22	240	3	71	88	18	76
Cuthbert fsl	6	6b Anderson	E	1	16	M	NC	40-42	21	250	3	41	63	13	71
		17a Morris	D	2	14	M	NC	42-44	20	240	2	34	62	15	75
Cuthbert fsl, mod. shallow	6s	8 Gregg	C	1	17	U	NC	42-44	21	250	4	54	67	13	65
Cuthbert fsl, thick surface	M6	3 Cass	G	1	21	M	NC	42-44	21	240	4	49	67	11	68
		5b Cass	C	1	22	M	NC	42-44	21	240	2	52	70	14	69
		6b Cass	C	1	24	M	NC	42-44	21	240	2	50	72	13	72
		9b Cass	C	1	24	U	NC	42-44	21	240	2	44	66	12	71
Cuthbert gfsl	6d	2a Franklin	E	1	16	M	NC	40-42	22	240	3	54	70	11	67
		2b Franklin	E	1	16	U	NC	40-42	22	240	4	49	63	10	64
Cuthbert gsl	6d	1 Harrison	F	2	10	U	NC	42-44	22	240	2	54	65	11	63
		12 Harrison	C	1	17	U	NC	42-44	22	240	3	45	61	13	65
Cuthbert lfs	11	2 Upshur	B	1	24	U	NC	40-42	20	240	3	48	53	11	57
		6 Upshur	E	1	24	M	NC	40-42	20	240	3	57	70	13	66
		9 Upshur	C	1	26	U	NC	42-44	20	240	3	61	68	13	62
		10 Morris	C	1	24	M	NC	42-44	20	240	3	47	64	11	65
Eustis lfs & fs	13	101a Cherokee	C	1	48	M	NC	40-42	22	245	6	36	57	11	68
		30 Cass	C	1	72	U	OF	42-44	21	240	10	59	68	12	62

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness: A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	Ave. total dbh	Site index
(1)		(2)	(3)	(4)	(5) inches	(6)	(7)	(8) inches	(9) inches	(10) days	(11) number	(12) years	(13) feet	(14) inches	(15)
ANNUAL PRECIPITATION LESS THAN 44 INCHES															
Kirvin fsl	6	9a Morris	F	1	8	L	NC	42-44	20	240	2	64	82	14	73
		7 Upshur	B	2	10	L	NC	42-44	20	240	4	38	64	14	74
		11 Morris	F	1	8	L	NC	42-44	20	240	3	45	72	11	75
		9a Anderson	C	1	15	U	NC	40-42	21	250	2	54	74	13	71
Kirvin gfsl	6d	9b Cherokee	D	1	18	M	NC	42-44	22	245	3	65	78	14	68
Lakeland fs	13	14 Cass	E	1	94	L	NC	42-44	21	240	3	59	64	10	60
		15 Cass	D	1	90	Lc	NC	42-44	21	240	4	58	64	10	58
		31 Cass	E	1	60	M	OF	42-44	21	240	7	60	67	12	61
Lakeland fs, very deep phase	M13	103 Anderson	C	1	103	U	NC	40-42	20	250	4	76	72	13	56
		102 Anderson	D	1	112	U	NC	40-42	20	250	3	65	65	14	57
Lakeland lfs	13	2a Anderson	C	1	58	U	NC	38-40	21	250	4	62	73	13	65
		2b Anderson	E	1	64	M	NC	38-40	21	250	3	59	73	14	66
		2c Anderson	B	1	66	L	NC	38-40	21	250	4	66	81	14	71
		1 Camp	C	1	60+	M	NC	42-44	20	240	3	45	62	11	67
		10a Cherokee	D	1	50	U	NC	40-42	22	245	3	75	80	14	67
		1 Hopkins	C	1	72	M	NC	38-40	22	240	3	39	56	12	63
		12a Houston	B	1	66	U	NC	42-44	22	250	3	57	74	15	69
		1 Smith	C	1	72	M	NC	40-42	20	240	1	44	60	12	64
		2b Smith	C	1	72	M	NC	40-42	20	240	2	49	65	12	66
		3 Smith	B	1	72	U	NC	40-42	20	240	2	45	60	11	63
		1 Upshur	C	1	55	M	NC	40-42	20	240	4	49	63	12	65
		4 Wood	E	1	54	M	NC	40-42	20	240	3	58	68	12	63
Nacogdoches fsl	6	6a Anderson	C	1	16	U	NC	38-40	21	250	3	45	65	13	69
		102a Cherokee	F	1	9	M	NC	40-42	22	245	3	36	62	12	73
Ruston fsl	7	4 Cass	C	1	26	Lc	NC	38-40	21	240	3	51	74	12	74
Ruston fsl, thick surface	M7	6c Anderson	B	1	28	Lc	NC	40-42	21	250	3	34	67	13	81
Ruston lfs	12	14 Morris	F	2	24	M	NC	38-40	20	240	3	37	66	10	76
		1a Cherokee	B	1	36	U	NC	38-40	22	245	3	51	79	15	78
		10a Cass	C	2	34	Lc	NC	38-40	21	240	6	50	77	14	77
		20 Morris	F	2	36	L	NC	38-40	20	240	3	58	74	13	74
Sawyer fsl	6	8 Red River	C	1	16	U	NC	42-44	22	240	3	55	65	13	78
Sawyer fsl, moundy	6-x	11a Red River	B	1	26	U	NC	42-44	22	240	5	70	81	17	69
		3 Red River	B	1	16	U	NC	42-44	22	240	3	46	63	10	66
		4a Titus	B	1	12	U	NC	42-44	20	240	3	47	62	13	65
		16a Red River	B	1	10	U	NC	42-44	22	240	3	84	82	19	65
		17 Red River	C	1	10	U	NC	42-44	22	240	3	63	81	15	73
		18 Red River	B	1	10	U	NC	42-44	22	240	2	84		16	68

APPENDIX TABLE 2 (cont'd) Soil-site index correlation plot for shortleaf pine. East Texas Timberlands (FC) Area. Sheet 8 of 8

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	dbh	Site index
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
					inches			inches	inches	days	number	years	feet	inches	
ANNUAL PRECIPITATION LESS THAN 44 INCHES															
Sawyer lfs	11	12 Morris	C	1	18	M	NC	42-44	20	240	3	41	58	11	64
		193b Montgomery	B	1	18	M	NC	42-44	22	260	3	47	74	13	77
Susquehanna fsl	5	4b Anderson	E	3	6	L	NC	38-40	20	250	3	44	69	14	73
		9 Red River	E	2	10	L	NC	42-44	21	240	4	36	63	14	76
		41 Harrison	E	1	10	L	OF	42-44	22	250	4	46	63	12	65
		2a Rusk	D	2	5	U	NC	42-44	22	235	3	36	65	13	77

APPENDIX TABLE 3. Soil-site index correlation plot data for longleaf pine. East Texas Timberlands (FC) Area.

Soil and unit symbol (1)*		Plot number and county (2)	Slope class (3)	Erosion class (4)	Thickness A horizon (5) inches	Plot position (6)	Past land use (7)	Ave. Precipitation: Annual (8) inches	Ave. Precipitation: Warm season (9) inches	Frost-free period (10) days	Trees measured (11) number	Ave. total Age (12) years	Ave. total Height (13) feet	dbh (14) inches	Site index (15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Boswell fsl & vfsl	5	112b Tyler	B	1	14	U	NC	46-48	24	250	3	39	72	15	86
		22 Tyler	D	1	16	M	NC	46-48	24	250	3	37	65	12	77
		9b San Augustine	C	1	7	U	NC	46-48	22	250	2	50	69	11	69
Bowie fsl	7	5 Jasper	C	1	13	M	NC	50-52	25	245	3	39	63	12	72
Bowie lfs	12	28 Tyler	D	1	27	U	NC	46-48	24	250	3	29	61	10	85
Caddo fsl & vfsl	7a1	4b Trinity	B	1	20	U	NC	44-46	23	250	3	45	77	14	81
		21c Sabine	B	1	18	Lc	NC	48-50	22	235	3	59	73	13	69
Caddo fsl, mod. shallow	M7sa1	9 Polk	B	1	40	M	NC	44-46	23	250	4	47	68	12	70
Conroe gfsl	6d	17 Polk	B	1	12	M	NC	46-48	23	250	5	47	66	11	66
Kirvin fsl	6	4a Newton	C	1	11	M	NC	52-54	25	245	3	45	74	13	78
Kirvin gfsl, mod. shallow	6sd	18a Tyler	C	1	10	U	NC	46-48	24	250	2	51	59	11	59
Kirvin lfs	11	23a Tyler	E	1	18	M	NC	46-48	24	250	4	43	67	13	75
		23b Tyler	D	1	16	L	NC	46-48	24	250	3	45	77	14	81
Lakeland fs	13	122 Jasper	E	1	48	M	NC	46-48	25	245	3	33	58	12	74
Lakeland lfs	13	1a Jasper	E	1	56	M	NC	46-48	25	245	4	54	68	13	65
		19 Trinity	A	1	47	U	NC	44-46	23	250	4	44	73	14	78
		21 Tyler	C	1	45	U	NC	46-48	24	250	3	46	69	14	73
Rains fsl, clay subetratum variant	M5a1	6c Trinity	B	1	41	M	NC	44-46	23	250	1	52	73	13	72
Ruston lfs	12	123 Jasper	E	1	21	M	NC	46-48	25	245	3	35	61	12	74
		124 Jasper	E	1	26	M	NC	46-48	25	245	4	36	62	12	74
		31a Tyler	C	1	28	U	OF	46-48	24	250	3	36	66	11	80
		24 Tyler	C	1	40	U	OF	46-48	24	250	3	35	70	11	87
Sawyer lfs	11	4 Polk	B	1	36	U	NC	44-46	23	250	3	68	84	15	73
		5 Polk	B	1	42	U	NC	44-46	23	250	2	56	81	16	77
		6 Polk	B	1	32	U	NC	44-46	23	250	4	56	83	16	78
Sawyer vfsl, moundy	6-x	2 Sabine	A	1	12	M	NC	46-48	22	235	4	62	81	16	73
Susquehanna fsl	5	7 Polk	D	1	7	M	NC	44-46	23	250	2	45	71	16	73

*Headings of numbered columns are explained on pages 89 and 90.

4-17609 Rev. 3-64

APPENDIX TABLE 4. Soil-site index correlation plot data for loblolly pine. East Texas Timberlands - Flatwoods (FCC) Area. Sheet 1 of 2

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	Ave. total dbh	Site index
(1)*		(2)	(3)	(4)	(5) inches	(6)	(7)	(8) inches	(9) inches	(10) days	(11) number	(12) years	(13) feet	(14) inches	(15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Acadia fsl	5a1	26 Hardin	A	1	10	N	NC	46-48	26	265	3	40	85	15	93
Acadia fsl & vfsl, thick surface	M5a1	4 Liberty	A	1	22	N	NC	50-52	25	265	3	41	88	13	95
Bowie fsl	7	2a Hardin	B	1	6	U	NC	48-50	26	265	4	53	89	17	87
Bowie fsl, thick surface	M7	11b Hardin	B	1	29	U	NC	48-50	26	265	2	28	61	15	82
		8 Harris	A	1	19	N	NC	44-46	22	290	5	43	84	15	89
Bowie lfs	12	23 Montgomery	A	1	26	N	NC	44-46	23	260	3	50	79	13	79
		100 Montgomery	B	1	36	N	NC	44-46	23	260	3	51	88	17	87
		109 Montgomery	B	1	25	N	NC	44-46	23	260	1	35	67	14	79
		110 Montgomery	B	1	34	N	NC	44-46	23	260	3	43	75	14	80
		160 Montgomery	B	1	20	U	NC	44-46	23	260	6	33	74	15	90
		161 Montgomery	B	1	22	U	NC	44-46	23	260	5	35	69	12	82
		111a Newton	A	1	42	N	NC	52-54	25	245	4	34	75	16	90
Byars vfsl, thick surface, moundy	M5a-x	103 Newton	A	1	20	N	NC	52-54	25	245	3	46	92	17	95
Caddo fsl & vfsl	7a1	104 Montgomery	A	1	18	N	OF	44-46	23	260	3	36	88	16	101
		163a Montgomery	B	1	18	N	NC	44-46	23	260	3	35	75	16	89
		154 Montgomery	B	1	10	N	NC	44-46	23	260	4	46	83	15	86
		162 Montgomery	B	1	13	N	NC	44-46	23	260	4	35	77	14	90
		557 Montgomery	A	1	12	N	NC	44-46	23	260	4	48	77	13	79
		586 Montgomery	A	1	16	N	NC	44-46	23	260	5	39	85	18	94
		3 Hardin	A	1	18	N	NC	48-50	26	265	3	55	93	18	90
Caddo fsl & vfsl, clayey substratum variant	M6a1	5 Montgomery	A	1	37	N	NC	44-46	23	260	3	34	77	13	92
		6 Montgomery	A	1	37	N	NC	44-46	23	260	3	45	87	17	92
		21 Liberty	A	1	36	N	NC	46-48	25	265	3	41	90	16	98
		19 Hardin	A	1	46	N	NC	50-52	26	265	3	36	85	14	98
		13 Polk	A	1	28	N	NC	46-48	23	250	6	40	87	15	98
		10 Jasper	A	1	33	N	NC	52-54	25	245	4	31	76	12	97
Caddo fsl, thick surface	M7a1	8a & b Orange	A	1	11	N	NC	52-54	28	275	2	34	80	16	97
		206 Montgomery	A	1	32	N	NC	44-46	23	260	4	48	83	15	85
		232 Montgomery	A	1	20	N	NC	44-46	23	260	6	46	87	15	90
		585 Montgomery	A	1	18	N	NC	44-46	23	260	6	39	87	15	97
		604 Montgomery	A	1	30	N	NC	44-46	23	260	4	39	85	16	95
		605 Montgomery	A	1	26	N	NC	44-46	23	260	5	48	90	18	92
Beauregard fsl	6	14 Jasper	C	1	14	M	NC	50-52	25	245	3	37	79	13	91
Eustis fs, Terrace Phase	13	100b Newton	A	1	78	N	NC	52-54	25	245	1	70	98	22	88

*Headings of numbered columns are explained on pages 89 and 90.

APPENDIX TABLE 4 (cont'd) Soil-site index correlation plot data for loblolly pine. East Texas Timberlands - Flatwoods (FCC) Area. Sheet 2 of 2

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness: A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	dbh	Site index
(1)		(2)	(3)	(4)	(5) inches	(6)	(7)	(8) inches	(9) inches	(10) days	(11) number	(12) years	(13) feet	(14) inches	(15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Garner c	1al	1 Chambers	A	1	5	N	NC	48-50	24	290	3	35	72	13	85
		17 Chambers	A	1	6	N	NC	48-50	24	290	3	47	83	14	85
		16 Liberty	A	1	5	N	NC	48-50	25	265	3	46	82	16	84
		103 Liberty	A	1	5	N	NC	46-48	25	265	3	39	82	17	90
		2 Liberty	A	1	5	N	NC	46-48	25	265	3	34	68	11	81
Iuka cl, frequently flooded	4b	22 Hardin	A	1	36	N	NC	50-52	26	265	4	35	85	16	100
Iuka fsl, undulating, frequently flooded	9b-u	7 Newton	A	1	18	N	NC	52-54	25	245	4	38	83	12	93
Klej fs, undulating	13-u	106b Newton	A	1	37	N	NC	52-54	25	245	2	38	77	14	86
Klej lfs	13	9 Hardin	A	1	60	N	NC	50-52	26	265	4	46	91	16	95
Klej lfs, thick surface	13	11a Jasper	C	1	42	L	NC	52-54	25	245	3	41	74	11	80
		4 Montgomery	A	1	42	N	NC	44-46	23	260	3	35	73	13	86
Klej lfs, undulating	13-u	23 Hardin	B	1	36	M	NC	52-54	26	265	4	37	82	13	94
		24 Hardin	B	1	48	M	NC	52-54	26	265	3	34	91	14	109
		105 Newton	A	1	58	N	NC	52-54	25	245	4	32	91	15	112
Lakeland fs	13	6 Hardin	B	1	60	L	NC	50-52	26	265	2	34	68	13	80
Magnolia fsl, terrace phase	7	7a & b Orange	A	1	14	N	NC	52-54	28	275	9	36	81	13	96
Rains vfsl	6a	217 Montgomery	A	1	6	N	NC	44-46	23	260	4	53	84	18	82
		30 Montgomery	A	1	7	N	NC	44-46	23	260	4	39	81	15	89
		219 Montgomery	A	1	6	N	NC	44-46	23	260	4	51	92	18	91
		233 Montgomery	A	1	4	N	NC	44-46	23	260	6	34	75	14	89
		247 Montgomery	A	1	10	N	NC	44-46	23	260	4	34	75	14	89
		575 Montgomery	A	1	20	N	NC	44-46	23	260	7	30	70	14	89
		587 Montgomery	A	1	18	N	NC	44-46	23	260	5	39	87	15	97
		588 Montgomery	A	1	15	N	NC	44-46	23	260	6	50	93	16	93
		589 Montgomery	A	1	18	N	NC	44-46	23	260	5	44	86	14	90
Rains vfsl, clayey subsoil variant	M5a	113 Newton	A	1	26	N	NC	52-54	25	245	3	35	68	14	79
Rains vfsl, thick surface	M6a	14 Hardin	A	1	29	N	NC	48-50	26	265	2	29	73	14	96
		27 Hardin	A	1	37	N	NC	48-50	26	265	5	43	89	15	94
		100 Hardin	A	1	32	N	NC	50-52	26	265	4	41	84	14	92
Sawyer fsl	6	13 Liberty	D	2	6	M	NC	46-48	25	265	3	37	80	12	92
Sawyer vfsl, moundy	6al-x	2 Harris	A	1	8	N	NC	46-48	22	290	3	42	79	13	86
		5 Harris	A	1	8	N	NC	46-48	22	290	3	37	79	15	91
		12a & b Newton	A	1	23	N	NC	52-54	25	245	3	39	78	11	100

4-17609 Rev. 3-64

APPENDIX TABLE 5. Soil-site index correlation plot data for shortleaf pine. East Texas Timberlands - Flatwoods (FCC) Area.

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	dbh	Site index
(1)*		(2)	(3)	(4)	(5) inches	(6)	(7)	(8) inches	(9) inches	(10) days	(11) number	(12) years	(13) feet	(14) inches	(15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Bowie fsl, thick surface	M7	20 Polk	A	1	26	N	NC	46-48	23	250	5	44	76	14	80
Bowie lfs	12	100b Montgomery	B	1	36	N	NC	44-46	23	260	3	56	83	14	78
		109b Montgomery	B	1	25	N	NC	44-46	23	260	4	36	66	17	79
		110b Montgomery	B	1	34	N	NC	44-46	23	260	3	42	69	11	75
Caddo fsl	7a1	163b Montgomery	B	1	18	N	NC	44-46	23	260	2	40	73	13	82
Eustis fs	13	100a Newton	A	1	78	N	NC	52-54	25	245	4	71	92	18	80
		102 Newton	A	1	52	N	NC	52-54	25	245	3	48	74	14	76
Klej fs, undulating	13-u	106c Newton	A	1	37	N	NC	52-54	25	245	1	33	67	13	83
Lakeland fs, very deep phase	M13	13 Newton	B	1	74+	N	NC	52-54	25	245	4	51	68	13	67
Ruston fsl, thick surface	M7	115 Jasper	C	1	22	M	NC	52-54	25	245	3	49	81	14	81

*Headings of numbered columns are explained on pages 89 and 90.

4-17609 Rev. 3-61

APPENDIX TABLE 6. Soil-site index correlation plot data for longleaf pine. East Texas Timberlands - Flatwoods (FCC) Area.

Soil and unit symbol		Plot number and county	Slope class	Erosion class	Thickness A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	Ave. total dbh	Site index
(1)*		(2)	(3)	(4)	(5) inches	(6)	(7)	(8) inches	(9) inches	(10) days	(11) number	(12) years	(13) feet	(14) inches	(15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE															
Acadia fsl & vfsl, thick surface	M5a1	9a Newton	A	1	19	N	NC	50-52	25	245	5	39	72	12	80
		9b Newton	A	1	19	N	NC	50-52	25	245	4	38	73	12	83
Bowie fsl & vfsl	7	1a Hardin	C	1	7	M	NC	48-50	26	265	3	56	80	16	76
		1b Hardin	B	1	7	U	NC	48-50	26	265	2	60	83	15	75
		2b Hardin	C	1	6	U	NC	48-50	26	265	3	52	81	16	79
		16 Jasper	B	1	18	U	NC	52-54	25	245	3	51	77	13	76
		11a Newton	B	1	12	U	NC	52-54	25	245	4	45	70	10	74
		11b Newton	B	1	11	L	NC	52-54	25	245	3	44	70	10	74
		15a Newton	B	1	18	U	NC	52-54	25	245	4	49	67	13	69
		16 Newton	B	1	18	U	NC	52-54	25	245	4	40	62	10	70
		26 Tyler	B	1	12	M	NC	48-50	24	250	3	46	76	12	79
		13 Jasper	A	1	13	M	NC	50-52	26	245	3	40	72	11	80
		108 Tyler	B	1	12	M	NC	46-48	24	250	5	51	74	14	72
Bowie fsl, moundy	7-x	101 Hardin	A	1	17	N	NC	50-52	26	265	4	57	88	15	83
		6a & b Jasper	B	1	17	U	NC	52-54	25	245	3	52	80	12	82
		7 Jasper	A	1	14	M	NC	50-52	25	245	4	36	66	13	80
Bowie fsl, thick surface	M7	11a Hardin	B	1	29	U	NC	48-50	26	265	2	43	71	16	77
		15b Newton	B	1	25	U	NC	52-54	25	245	2	47	71	13	74
		25 Tyler	B	1	22	U	NC	48-50	24	250	12	44	79	12	85
Bowie lfs	12	112 Newton	A	1	33	N	NC	52-54	25	245	3	42	73	13	81
Klej fs	13	108 Newton	A	1	38	N	NC	52-54	25	245	5	44	69	14	74
Klej fs, undulating	13-u	106a Newton	A	1	37	N	NC	52-54	25	245	4	42	74	14	82
Klej lfs,	13	110 Newton	A	1	72	N	NC	52-54	25	245	4	45	75	11	80
		3a Tyler	A	1	48	N	NC	48-50	24	250	4	50	84	12	85

*Headings of numbered columns are explained on pages 89 and 90.

APPENDIX TABLE 7. Soil-site index correlation plot data for loblolly pine. Coast Prairie (CO) Area.

Soil and unit eymbol	Plot number and county	Slope class	Erosion class	Thickness: A horizon	Plot position	Past land use	Ave. Precipitation: Annual	Ave. Precipitation: Warm season	Frost-free period	Trees measured	Ave. total Age	Ave. total Height	Ave. total dbh	Site index
(1)*	(2)	(3)	(4)	(5) inches	(6)	(7)	(8) inches	(9) inches	(10) days	(11) number	(12) years	(13) feet	(14) inches	(15)
ANNUAL PRECIPITATION 44 INCHES AND ABOVE														
Beaumont c	1al 102 Liberty	A	1	6	N	NC	50-52	25	265	5	35	77	16	90
	6 Liberty	A	1	33	N	NC	50-52	25	265	3	35	74	12	86
	2 Chambers	A	1	28	N	NC	48-50	24	290	3	36	71	12	82
Clodine vfsl	6al 3 Harris	A	1	12	N	OF	44-46	22	290	4	36	80	15	92
Edna cl	1al 1 Jefferson	A	1	8	N	OF	50-52	28	290	4	27	66	13	92
	21 Hardin	A	1	13	N	OF	50-52	26	265	3	41	95	19	103
	14a Orange	A	1	16	N	NC	50-52	28	275	3	29	72	14	95
Edna fsl & vfsl, moundy	5al-x 2ab Orange	A	1	13	L	NC	52-54	28	275	4	38	83	15	94
	12al Orange	A	1	17	M	OF	50-52	28	275	3	36	71	14	82
	101 Liberty	A	1	10	L	NC	50-52	25	265	4	38	81	14	92
Hockley fsl, imp. drained	M6al 10 Harris	A	1	35	N	NC	42-44	22	290	5	42	81	15	87
	12 Harris	A	1	33	N	NC	44-46	22	290	5	34	67	13	80
Katy fsl	M5al 14 Harris	A	1	18	L	NC	44-46	22	290	3	52	96	16	94
	100 Liberty	A	1	22	U	NC	50-52	25	265	4	38	82	15	92
Katy fsl & vfsl, moundy	M5al-x 31 Hardin	A	1	23	N	NC	50-52	26	265	3	43	86	14	91
	28b Hardin	A	1	27	N	NC	50-52	26	265	2	29	63	14	95
	2 Orange	A	1	18	N	OF	50-52	28	275	5	34	82	14	99
	6 Orange	A	1	16	N	OF	50-52	28	275	2	37	80	19	92
Sabine lfs	13 4 Chambers	A	1	52	M	NC	50-52	24	290	3	38	86	13	97
	5 Chambers	A	1	74	U	NC	50-52	24	290	3	49	86	14	87
Waller cl, drained	1a 102 Orange	A	1	21	N	NC	50-52	28	275	4	33	82	17	99
Waller vfel, drained	M5a 11 Orange	A	1	20	N	OF	50-52	28	275	6	42	101	18	109
	100a & b Orange	A	1	19	N	OF	50-52	28	275	5	56	119	24	114
DATA FOR LONGLEAF PINE														
Katy fsl, moundy	M5al-x 28a Hardin	A	1	27	N	NC	50-52	26	265	4	36	72	14	85

*Headings of numbered columns are explained on pages 89 and 90.

4-17609 Rev. 3-64

CRITERIA USED IN RATING SOILS FOR WOODLAND CONSERVATION

Potential Soil Productivity. Average site index for each adapted forest species is accepted as the best indicator of potential soil productivity. Site index is determined by the following steps: (1) measuring the total age and total height of a number of dominant and codominant trees in a well stocked, even aged stand on the soil being investigated, (2) these measurements are plotted on published index curves for the species, and (3) results of plotting from data on individual trees are then averaged for the site index of the sample plot. Results from a number of such sample plots are taken to obtain a reliable average site index for each species for each soil. Site index is the average total height of the dominant and codominant trees at 50 years of age. In this report, the site index is rounded off to the nearest 5 feet for the woodland suitability groups. Published yield tables (Appendix Tables 8, 9, 10, and 11) provide quantitative yield predictions for different site index classes. Site index of slash pine is expected to approximate that of loblolly.

Seedling Mortality. This is the normal expected degree of mortality of naturally occurring or planted tree seedlings as influenced by kinds of soil in the establishment period. For plantations, it assumes use of planting stock of proper grade, in a healthy condition when planted, and proper planting methods. For naturally occurring seedlings it assumes an adequate seed supply. Normal environmental factors are assumed for both natural and planted seedlings. The rating classes and criteria used for rating are:

1. Slight - No special regeneration problems. Ordinary losses expected due to soil influences should not be over 25 percent of planted stock; satisfactory restocking from initial planting can normally be expected. Ordinarily, adequate natural regeneration will take place.

2. Moderate - Moderate regeneration problems. Expected losses due to soil influences would ordinarily be 25 to 50 percent. Normally, some replanting may be necessary to fill in openings. Some seedbed preparation may be advisable. Natural regeneration cannot always be relied on and special treatment measures may be needed.

3. Severe - Difficult regeneration problems. Natural regeneration cannot be relied on. Expected losses due to soil influences are ordinarily over 50 percent for planted seedlings. Satisfactory restocking by either initial planting or natural regeneration can be expected only in years of most favorable rainfall. Considerable replanting, special seedbed preparation, good planting techniques and good quality seedlings are essential to assure adequate restocking of these soils.

Plant Competition. This is the degree of competition and rate that undesirable species invade different soils when openings are made in the canopy and adequate seed sources of invaders are present.

1. Slight - No special plant competition problems. Kinds of soils are such that invasion by undesirable species will only slightly impede natural regeneration and growth of the management species.

2. Moderate - Moderate plant competition problem. Competition develops on these soils, but will not ordinarily prevent adequate stand establishment of the management species. Establishment may be delayed and initial growth slowed, thereby delaying the development of a normal fully stocked stand. Some site preparation may be necessary in order to establish an adequate stand without delay.

3. Severe - Plant competition is a severe problem. Plant competition is so severe that natural regeneration without special treatment measures cannot be relied on to provide adequate restocking of management species.

   Special management and site preparation treatments are needed, such as prescription burning, use of chemicals, girdling, and tree planting with some replanting to assure fully stocked stands.

Equipment Limitations (Trafficability). This reflects the soil characteristics and topographic features that restrict or limit the use of equipment commonly used in planting operations, crop tending, and tree harvesting. Wetness is one of the dominant factors. Other factors are plastic clay at or near the surface, steepness of slopes, and lack of traction on dry loose sands. The rating classes are:

1. Slight - No special equipment limitations exist. Equipment use is generally not restricted in kind or time of year.

2. Moderate - Moderate equipment limitations exist. Type of equipment is only moderately limited due to soil or slope of land. There is normally a seasonal restriction, usually about 3 months, in use of equipment, if due to wetness. Use of equipment during the wet period is apt to result in damage to soil structure and injure tree roots. Moderate limitation may be due to steep slopes or loose dry sands.

3. Severe - Severe equipment limitations exist. Equipment use is severely limited due to soil wetness. The problem may be for continuous periods greater than 3 months. Equipment use during wet periods may result in severe damage to tree roots and "puddle" the soil.

Erosion Hazard. This is the erosion hazard of the soil when the area is managed according to currently recognized acceptable standards. Ratings may lead to development of special techniques in management, and special attention to road, trail and landing location, construction and maintenance.

The rating classes are:

1. None to Slight - Erosion hazard is none to slight. Soils normally occupy level to gently sloping landscapes. No special techniques in management are necessary to control erosion.

2. Moderate - Erosion hazard is moderate. Some provision in management must be made to prevent erosion. Location of roads, skid trails, fire lanes and landings, as well as construction and maintenance, require some special techniques.

3. Severe - There is a severe erosion hazard. Special techniques in management including protection of forest litter and use of equipment on the contour and special attention to road, skid trail, fire lane, and landing location as well as special techniques in construction and maintenance, are necessary to prevent erosion.

Windthrow Hazard. This is the susceptibility to windthrow as related to soil characteristics that determine stability and tree-root development affecting wind firmness. Ice glaze on timber also may cause uprooting similar to the damage from wind. The susceptibility to windthrow of different soils is important in making recommendations for stand density control in thinnings, release cuttings, regeneration, and final harvest cuttings. The rating classes are:

1. Slight - No special problem is recognized. Kinds of soils where root development of the management species is normal and exposure to normal wind does not result in problems of windthrow. Individual trees would be expected to remain standing when released on all sides.

2. Moderate - A moderate windthrow problem is recognized. Kinds of soils where root development of the management species is adequate for stability except for periods of excessive wetness and during periods of greatest wind velocity.

3. Severe - A serious problem is recognized. Kinds of soils where depth of tree rooting does not give adequate stability. The restriction in rooting depth may be due to water level or a restrictive layer in the soil. Individual trees would likely be blown over if released on all sides.

Hazards from Forests Pests. This is the expected damage or mortality of stands due to pests such as Texas leaf cutting ants gophers, whose activities are associated with soil characteristics. The rating classes are:

1. Slight - Expected mortality and damage from forest pests is slight.

2. Moderate - Moderate mortality and damage can be expected from forest pests. Some replanting and pest control may be necessary to assure fully stocked conditions.

3. Severe - Severe mortality or damage may be expected from forest pests. Pest control may need to be considered before planting.

APPENDIX TABLE 8 - Average Stand & Yield Information for Overstocked Unmanaged, Naturally Occurring Stands (from USDA Misc. Pub. 50)

Loblolly Pine

Site Index	Age	Total Volume Per Acre			Height Dom. Stand[4]	Av. Diam.[5] Total Stand	Total Trees Per Acre[5]
	Years	Cu.Ft.[1] [5]	Cords [2]	Bd.Ft.[3]	Feet	Inches	Number
	20	1,900	12	-	35	3.6	1,600
	30	2,900	25	-	48	5.4	850
60	40	3,750	35	1,000	55	6.8	585
	50	4,350	41	3,000	60	7.9	440
	60	4,750	46	5,000	64	8.9	360
	70	5,000	49	7,000	67	9.7	310
	80	5,150	51	8,500	69	10.4	275
	20	2,200	17	-	42	4.3	1,185
	30	3,400	31	1,000	55	6.5	640
	40	4,450	42	3,500	64	8.1	435
70	50	5,200	50	6,500	70	9.4	325
	60	5,700	55	10,000	75	10.6	270
	70	6,000	59	12,500	78	11.5	230
	80	6,250	62	15,000	80	12.3	205
	20	2,550	22	-	48	5.0	950
	30	4,000	38	2,000	63	7.4	510
	40	5,250	51	6,000	73	9.2	345
80	50	6,150	60	11,500	80	10.7	255
	60	6,700	66	16,000	85	12.0	210
	70	7,100	70	19,500	89	13.1	185
	80	7,400	73	22,000	92	14.0	160
	20	3,000	27	-	54	5.6	790
	30	4,750	46	4,000	71	8.2	420
	40	6,200	61	10,000	82	10.2	290
90	50	7,250	71	16,500	90	12.0	220
	60	7,850	78	22,000	96	13.4	180
	70	8,300	82	26,000	100	14.6	150
	80	8,600	85	29,000	103	15.6	135
	20	3,450	32	500	59	6.1	690
	30	5,500	53	6,000	78	9.0	375
	40	7,200	71	14,500	91	11.2	255
100	50	8,450	84	23,000	100	13.1	190
	60	9,150	92	29,500	107	14.6	155
	70	9,600	96	33,000	112	15.9	135
	80	9,950	100	35,500	115	17.1	115
	20	3,950	37	1,000	65	6.6	615
	30	6,250	62	9,000	85	9.7	335
	40	8,300	82	20,000	100	12.1	225
110	50	9,700	96	29,500	110	14.1	170
	60	10,550	106	36,500	118	15.9	140
	70	11,100	112	40,500	122	17.3	120
	80	11,400	116	43,500	126	18.4	105

1/ Unpeeled, stand 2" dbh and over.
2/ Rough Wood, stand 4" dbh and over.
3/ Doyle Scale, stand 9" dbh and over.
4/ Height Dominant Stand revised according to Coile and Schumacher, 1953.
5/ Stand 2" dbh and over.

APPENDIX TABLE 9 - Average Stand and Yield Information for Overstocked Unmanaged, Naturally Occurring Stands
(From USDA Misc. Pub. 50)

Slash Pine

Site Index	Age	Total Volume Per Acre			Height Dom. Stand	Aver. Diam. 4/ Total Stand	Total Trees Per Acre 4/
	Years	Cu.Ft. 1/	Cords 2/	Bd.Ft. 3/	Feet	Inches	Number
60	20	2,700	20	-	36	3.5	2,035
	30	3,500	32	-	48	5.0	1,140
	40	4,150	40	500	55	6.3	710
	50	4,600	45	2,000	60	7.2	550
	60	4,900	48	3,500	64	7.9	470
70	20	3,250	28	-	42	4.2	1,445
	30	4,250	40	500	56	6.0	820
	40	5,000	49	2,500	64	7.5	500
	50	5,650	55	5,500	70	8.5	390
	60	6,100	59	7,500	74	9.4	335
80	20	3,800	35	-	48	4.9	1,090
	30	4,950	48	1,500	63	7.0	610
	40	5,850	58	6,000	73	8.7	380
	50	6,600	65	10,000	80	10.0	295
	60	7,150	69	12,500	85	10.8	250
90	20	4,250	41	-	54	5.6	835
	30	5,550	54	4,000	71	8.0	470
	40	6,650	66	10,000	83	10.0	295
	50	7,500	73	15,000	90	11.4	220
	60	8,100	78	18,000	95	12.5	195
100	20	4,650	46	1,000	61	6.4	625
	30	6,100	59	7,000	79	9.1	365
	40	7,350	72	14,500	92	11.4	225
	50	8,300	81	19,500	100	13.1	175
	60	8,950	86	23,000	106	14.2	150

1/ Unpeeled, stand 2" dbh and over.
2/ Rough Wood, stand 4" dbh and over.
3/ Doyle Scale, stand 9" dbh and over.
4/ Stand 2" dbh and over.

APPENDIX TABLE 10 - Average Stand & Yield Information for Overstocked Unmanaged, Naturally Occurring Stands (From USDA Misc. Pub. 50)

Shortleaf Pine

Site Index	Age	Total Volume Per Acre			Height Dom. Stand 4/	Aver. Diam. 5/ Total Stand	Total Trees 5/ Per Acre
	Years	Cu.Ft. 1/	Cords 2/	Bd.Ft. 3/	Feet	Inches	Number
	20	1,350	-	-	32	2.5	3,425
	30	2,460	23	-	39	3.9	1,855
	40	3,390	33	-	46	5.1	1,085
50	50	4,070	43	1,600	50	6.1	760
	60	4,500	48	3,200	55	6.9	590
	70	4,820	51	5,050	59	7.6	485
	80	5,090	53	7,000	62	8.3	420
	20	1,720	12	-	37	2.9	2,520
	30	3,140	32	-	47	4.6	1,370
	40	4,300	46	1,550	54	6.0	815
60	50	5,150	54	4,350	60	7.2	570
	60	5,720	60	7,600	66	8.2	445
	70	6,180	65	10,250	71	9.0	370
	80	6,530	68	12,700	74	9.8	315
	20	2,120	18	-	43	3.5	1,965
	30	3,900	41	750	53	5.4	1,060
	40	5,290	56	4,000	62	7.0	625
70	50	6,300	66	8,650	70	8.3	440
	60	7,030	73	12,600	77	9.4	345
	70	7,600	79	16,250	82	10.4	285
	80	8,030	83	19,400	86	11.2	240
	20	2,540	25	-	50	4.1	1,495
	30	4,510	48	1,950	62	6.2	815
	40	6,150	65	7,650	72	8.0	485
80	50	7,400	77	13,550	80	9.5	335
	60	8,270	85	18,850	88	10.8	260
	70	8,930	92	23,450	94	11.9	215
	80	9,480	97	27,550	99	12.9	185
	20	2,820	30	-	56	5.0	1,080
	30	5,120	54	4,550	70	7.3	590
	40	7,050	73	12,600	81	9.4	345
90	50	8,490	87	20,450	90	11.2	245
	60	9,510	98	27,400	99	12.8	185
	70	10,300	105	32,850	106	14.1	160
	80	10,920	112	37,400	111	15.3	140

1/ Unpeeled, stand 2" dbh and over.
2/ Rough Wood, stand 4" dbh and over.
3/ Doyle Scale, stand 9" dbh and over.
4/ Height Dominant Stand revised according to Coile and Schumacher, 1953.
5/ Stand 2" dbh and over.

4-17609 REV. 3-64

APPENDIX TABLE 11 - Average Stand & Yield Information for Overstocked Unmanaged, Naturally Occurring Stands (From USDA Misc. Pub. 50)

Longleaf Pine

Site Index	Age	Total Volume Per Acre			Height Dom. Stand	Aver. Diam.[4] Total Stand	Total Tree Per Acre[4]
	Years	Cu.Ft.[1]	Cords[2]	Bd.Ft.[3]	Feet	Inches	Number
	20	1,000	4	-	26	2.8	1,410
	30	1,450	11	-	37	4.1	900
	40	1,850	17	-	45	5.1	625
50	50	2,250	21	500	50	5.9	505
	60	2,600	25	1,000	55	6.6	430
	70	2,950	28	2,000	58	7.2	375
	80	3,200	31	2,500	61	7.8	335
	20	1,500	8	-	31	3.3	1,290
	30	2,200	19	-	44	4.9	815
	40	2,900	27	500	53	6.0	575
60	50	3,550	34	2,000	60	7.0	465
	60	4,100	40	3,500	65	7.8	395
	70	4,600	45	5,000	70	8.5	345
	80	4,950	49	7,000	73	9.1	305
	20	2,000	14	-	36	3.8	1,150
	30	3,000	28	-	52	5.5	730
	40	3,950	39	2,000	62	6.8	515
70	50	4,800	48	4,500	70	7.9	415
	60	5,600	55	7,000	77	8.8	355
	70	6,200	62	9,500	82	9.6	305
	80	6,800	67	12,500	86	10.3	270
	20	2,450	20	-	41	4.3	1,050
	30	3,700	36	1,000	59	6.1	655
	40	4,900	49	4,000	71	7.6	465
80	50	6,000	61	7,500	80	8.8	375
	60	7,000	70	11,500	87	9.8	315
	70	7,850	78	15,500	93	10.6	270
	80	8,550	85	19,500	98	11.5	240
	20	2,800	26	-	46	4.7	910
	30	4,350	43	2,000	66	6.7	575
	40	5,800	59	6,500	80	8.3	405
90	50	7,150	72	11,500	90	9.6	330
	60	8,350	84	17,000	98	10.7	275
	70	9,400	94	22,500	105	11.6	240
	80	10,250	103	27,500	110	12.5	210

1/ Unpeeled, stand 2" dbh and over.
2/ Rough Wood, stand 4" dbh and over.
3/ Doyle Scale, stand 9" dbh and over.
4/ Stand 2" dbh and over.

4-17609 REV. 3-64